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## TRADE CULTIVATION.

It is well that our Government should spend $50,000 or even $100,000 in ascertaining the lines of least resistance for the development of export trade. There is a great deal to learn on the subject, and little that is systematic has been done since Mr. Frank A. Vanderlip made his intelligent explorations abroad on behalf of the United States Treasury, when he was connected with it. American ministers and consuls do excellent work in filing reports and answering questions, but such efforts are necessarily spasmodic and in need of correlation. The new plan promises good results. We hope that the opportunities for the larger export of electrical goods will receive full attention, believing as we do that in such articles there lie very great possibilities of increasing the export trade. The bulk and scale on which electrical apparatus is made in this country put it into most open foreign markets on equal terms, and even in "closed" markets it finds as ready entrance on the grounds of quality and price as do the like goods from any other country. The electrical industries of America double every five years, a rate at which consumption soon becomes enormous, with consequent lowering of price. Electrical service is one of the few things in this country that has steadily cost less during the last 10 years, in spite of the universal tendency toward higher costs in living and manufacturing.

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Some of the difficulties in the way of larger export trade as pointed out recently by a bank president in discussing Latin-American powers of absorption are lack of steamship facilities, want of banking facilities, uncouthness of traveling representatives, refusal of credit facilities, improper packing, and general non-accommodation of customers. To these might well be added lack of information abroad as to American products. But all these are susceptible of improvement; some of them can be removed entirely. Perhaps it will be some time before Americans can give banking facilities and credits abroad as freely as do English, German or French financiers and merchants; but our recent attitude in regard to the Chinese loan, our participation in the Japanese loans, our operations in Mexico, all point to coming changes in that respect. The demand for new capital to develop our own vast resources will continuously be intense, but American capital has already shown that it has international fluency; and that in turn means a great stimulus to export trade. Meantime, electrical producers of all kinds have their duty set before them clearly in trying to ameliorate the evils enumerated above. To show what such things mean, we note as this is being written that $200,000,000 of French capital is now going into Brazil, our authority being the President of the Republic himself. It follows that the engineering enterprises thus fostered will draw heavily on French materials and supplies; but some of this work was ready for American backing and was offered to this country. What applies to French capital is not less true of English and German.

## The Price of Electric Service.

Professor Marks' able discussion of this topic in our issue of last week will arouse, we think, a touch of new interest in a hackneyed subject. The pros and cons of various methods of charging for electric service have been theshed over so often that anything new is seldom disclosed, yet an orderly exposition of the fundamental facts is always in order. Of making systems of charging there is no end; and, while the general principles of most of them are similar, their ramifications are in almost endless variety. As Professor Marks very justly indicates, the basic fact in most modern systems of charging is the difficulty in cheaply storing electrical energy, which causes the consumer's demand to be an important instead of an insignificant factor in the cost of serving him. Hence the very general introduction of some form of standing charge based on estimated or measured demand plus a service charge based, in the last report, upon the operating costs. There has been upon the whole a public recognition of the fairness of the general proposition which is very gratifying. It is to the details of this rate-making plan, however, that one must look for a final judgment upon the particular plan adopted. Broadly, there are objections, and sound ones, to any scheme yet projected. No application of a general law is sound unless it takes account of the adaptability of that law to the concrete problem in hand. On the other hand, it is no arraignment of the main principle to bring up cases that are without its scope. In such cases one merely finds usually that the law is not in its general form, as when one tries to deal with high-frequency currents by the sole aid of Ohm's law in its simplest form.

Now, in the rate-making process there is one fact too commonly overlooked to which we have over and over called attention. That fact relates to the consumers' demand in its bearing on the standing charge. It is emphatically and evidently untrue that the capacity of a central station doing ordinary urban business must be equal to the sum of the consumers' maximum demands, still less to the sum of their connected loads. Central-station men, of course, have time and again recognized this and have acted upon it. In other words, the capital required for the actual standing service of a consumer is not generally in fact determined by his maximum demand. The condition under which it would be exists only in the mind of the doctrinaire. The determining factors actually include the time and the place of the load as well, and until these things are recognized it will be idle to make anything like a logical standby scheme equally fair to all kinds of consumers; and a system that systematically punishes by the effect of its incomplete assumptions certain groups of consumers, has not yet the essential elements of logical completeness. This statement denies neither the usefulness nor the business-like adaptability of many schemes of charging now used. They deal with the time and place factors by general average, and ill or well according to the skill with which this average is handled. So, indeed, one can deal with the amount of demand itself by average, as is implicitly done in the two-rate system. Every study of rates is valuable as disclosing new bearings of the essential facts; and while it is safe to say that the whole problem is somewhat too complex for general statement, one can yet arrive at proximate solutions of value, as Professor Marks has done. The whole subject is not a science, but a fine art, like most of skilled human attempts to deal with diversified human affairs. Practically each city presents its own rate-making problems, and these must be worked out by patient application to the physical and human data before one.

## The Design of Stationary Transformers.

In determining the relations between the electric and magnetic circuits of a stationary transformer, one cannot fail to be impressed with the fact that the calculations connected with the electrical requirements are of minor difficulty compared with those relating to the thermal and mechanical requirements. For example, if the core is to be subjected to a certain loss per pound, then there exists a definite, easily determined relation between the cross-sectional area of the core and the number of turns in each coil, the product of the area and the turns being a constant. However, the design problem is far from being solved when the value of this constant has been ascertained; an indefinite range remains for the choice of the exact value of the area or turns, while no account has yet been taken of the temperature limits, mechanical requirements, life of the insulation and the output characteristics. The latter features are of predominating importance, and cannot be treated so simply as can the purely electrical features. There are several practical features of construction and operation of a transformer which serve as a guide to the designer. For example, the amount of separation between coils is determined by the voltage and the character of the insulation to be employed, while the maximum efficiency is obtained when the copper loss equals the iron loss.

Even when these features are fully considered, the problem still contains many variables for which values must be selected by the designer. Suggestions concerning methods that may be employed in selecting the final dimensions are given in an article elsewhere by Mr. Roger P. Heller, while the effect of changing the design proportions are treated at length in an article by Mr. E. G. Reed. Attention should be called to a statement in the latter article that the total losses in a transformer will be a minimum when the iron loss is approximately 15 per cent greater than the copper loss, which statement may seem to be in conflict with the well-known fact that the maximum efficiency occurs at that load, causing the two losses to be equal. The author's demonstration is based on an assumed change in the e.m.f. at constant output, while a transformer is usually operated at constant e.m.f. with changing output. Each conclusion is in accordance with the initial assumptions.

## The Distribution of Electric Stress in Three-Phase Cables.

An interesting paper by Messrs. W. M. Thornton and O. J. Williams on the above subject was presented at the Winnipeg B. A. meeting. In order to indicate visually the electric flux-paths in the three-conductor cable, the authors prepared a hydrodynamic model of such a cable. The model consisted of a glass cell formed of a pair of flat circular glass plates clamped closely together with a thin water-tight rim washer. The sections of insulator were represented in the model by thin clearance films, the space between the glass disk being filled in with wax. The sections of conductor were represented in the model by

circular cavities without any wax filling. A circular trough round the edge of the model just inside the rim washer represented the conducting lead sheath of the cable. Through three perforations in one of the glass disks, glycerine could be admitted and withdrawn from the cell. The admission nozzle introduced alternate jets of clear and red glycerine, so that the liquid stream lines showed themselves in colored lines within the model. By using pinch cocks on the two outlets, and pinching them differentially, various conditions of phase-difference in an alternating-current cycle could be manifested and photographed. The liquid stream-lines in the model corresponded to electric stream-lines in the cable, and the liquid stream velocities to electric stress. The pictures obtained from the model are in substantial agreement with those heretofore obtained by calculation. The model must be very fascinating to watch when the two outlets are pinched cyclically, so as to imitate alternating voltage application.

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The paper points out that when the three conductors of a three-phase cable are changed in cross-section from the circular to the "clover-leaf" form, as is a practice, especially in Europe, the intensity of the electric stress in the layers of insulator close to the conductors is markedly reduced. This has been known from computation and it is manifestly by the hydrodynamic model. In fact, the paper may be considered as a tacit plea for clover-leaf section, three-phase cables. Much ingenuity and mechanical skill are required in the preparation and manipulation of these hydrodynamic models. The specific inductive capacity of the insulation material has to be imitated in a model by the precise degree of thickness of the thin film between one glass wall and the wax layer built on the opposing wall. A very small error in the thickness of this film will distort the liquid stream lines considerably and give a picture which corresponds to some modified quality of cable. The same principle has already been applied to the illustration of magnetic problems, but this seems to be the first use of the principle for visualizing the flow lines in electric distributions. It should be capable of affording an instructive lecture experiment.

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## Atmospheric Loss Off High-Tension, Direct-Current Circuits.

Among the papers presented to the British Association for the Advancement of Science at the Winnipeg convention is one by Mr. E. A. Watson, on the electrical corona. This paper contains much interesting matter, both from the theoretical and practical points of view. It adduces the results of an experimental research on coronal formation around cylindrical wires, as the electric potential was increased. The source of this potential was an influence machine, so that the experiments were all of the unidirectional, or direct-current, type, as distinguished from the usual alternating-current type. There are certain manifest advantages pertaining to direct-current corona tests, as the voltage and current are relatively easy to measure, and the question of their difference of phase is mercifully eliminated. Almost all of the results are stated in terms of electric intensity at the surface of the tested wire, in kilovolts per centimeter, as deduced from the critical coronation voltage, and the geometry of the wire system. There are certain advantages and certain disadvantages in expressing the results this way. Air, at ordinary barometric pressures, crushes electrically at an intensity of about 40 kv per centimeter, or 100 kv per inch, when the intensity is applied between opposed parallel plane-surface conductors. It is very doubtful as to what the crushing intensity is when we use small wires. A corona forms when air is crushed in the immediate vicinity of a wire, without actual discharge to a distance.

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The corona is the visible evidence of the crush, and the ammeter in the wire circuit also gives evidence of the same; but the presence of the corona virtually extends the boundary of the wire, because the corona is itself a fairly good conductor. The maximum stress on the air molecules is therefore conveyed to the surface of the corona as though the wire had been enlarged. All conclusions as to the magnitude of the maximum stress at the wire surface based on the metallic diameter are thus vitiated and rendered unreliable. This state of things is suggested by the results given in the paper. The apparent critical intensity at the wire surface was 80 kv per centimeter with small wire of less than 1 mm in diameter, but approached 40 kv per centimeter with wires of about 1 cm in diameter. The paper points out in fact that at normal barometric pressure the critical coronation intensity tends to reach about 40 kv per centimeter as the wire diameter increases. The results reported are shown to be in remarkably close agreement with those reported by Professor Ryan in his classical A. I. E. E. paper of February, 1904. Ryan's results were all obtained with alternating-current excitation. Consequently, it is the maximum voltage applied to a wire that determines its coronation, and whether that maximum is steadily maintained in direct-current fashion, or whether it is only reached momentarily once each half cycle in alternating-current fashion, apparently does not matter.

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Watson's paper lays emphasis on the surface condition of the wire tested. If the wire is clean, it takes a higher coronation voltage than if it is dirty. Of course, this is explainable on the basis of geometry. A clean wire is a pure cylinder down to the molecular dimensions, whereas a dirty wire is a cylinder with sharp points and projections. Ionization of the air will be sooner likely to occur at the greater electric intensities near the points, when the potential is raised. Curiously enough, Watson's paper reports no appreciable influence of moisture vapor in the coronation voltage of air under laboratory conditions when the wire is clean. With dirty wires in the open air, the loss into the air was much greater and was affected by water vapor. It is suggested, however, that the water vapor produced a leakage loss before the coronation voltage was reached. A factor of safety of 2 is recommended, therefore, for application, in practice, to the critical voltages obtained in the laboratory with clean wires. Working with reduced barometric pressures down to about half an atmosphere, the coronation voltages were reduced, in straight line law, roughly proportional to the pressure; so that, on high mountains, the coronation voltage should be lower than on the plains. A remarkable difference in the quality of the corona was found according as the potential of the wire was positive or negative, and there was also a small noticeable difference in the coronation voltage between the two conditions. The paper is a valuable contribution to this important subject. Much remains, however, to be cleared up.

## Winnipeg Convention of the British Association for the Advancement of Science.

Our issue for last week contained an account of the convention of the British Association for the Advancement of Science, then being held at Winnipeg, Canada, while abstracts of several of the papers presented are given in the present issue.

The convention was attended by scientists from virtually every civilized country. Many new theories were advanced and the year's work of the men at the head of their respective lines were set forth in the papers. The scientists were divided into 12 sections, each of which was devoted to a particular branch of study, and in this way those interested were able to attend the lectures pertaining to their calling. The bulk of the electrical papers came under the heading of "Engineering."

The address of President Thomson on "Positive Electricity," which was outlined in our issue for last week, was said to be the most complete ever delivered on this subject. Mr. Ormond Higman, chief electrical engineer of the Electrical Standards Laboratory, Ottawa, Canada, explained "International Electrical Standardization" in a lengthy paper giving the rules in various countries for testing electrical apparatus. He said that the United States was the first country to study the subject, taking up the work in 1899 when the first report on the subject was issued by the American Institute of Electrical Engineers. France, Germany and Great Britain followed with their respective ruling which, though dealing with practically the same subjects, contained many differences. He apologized for following in the steps of Sir John Wolfe Barry, K.C.B., who read a somewhat similar paper before the association meeting at York, England, in 1906. "The Distribution of Dielectric Stress in Three-Phase Cables" was the subject of a paper given by Professor W. M. Thornton and G. J. Williams. The voltage gradient at any point in the cross-section of a three-core cable as used for three-phase currents at any time during the cycle of electricity was dwelt on at much length. It was stated that it appears impracticable to attempt to solve it analytically by finding and superposing the fields between the various conductors in turn. In addition to the papers mentioned above there were several in the physics section which dealt with the subject more in a theoretical than a practical way.

These lectures were given mostly during the mornings, afternoons and evenings being devoted to trips to points of interest to the various sections. The agriculturalists visited the farm lands around Winnipeg; the educationalists made a round of the various schools and colleges in Winnipeg and the immediate vicinity; the engineers saw the bridges, the railroad shops, high-pressure water system, St. Andrews locks and other engineering features. Those interested in the electrical branch made two trips—one to the civic power plant under construction at Point du Bois and the other to the electrical station and other works of the Winnipeg Electric Company.

A large number took in the trip to the power plant being built by Winnipeg at Point Du Bois, a distance of 65 miles from the city. Mr. Cecil B. Smith, who has charge of the construction, accompanied the tourists and explained in detail the working of the plant which, when completed, will have cost approximately $3,500,000. The visitors were generally surprised when informed that the city expects to be able to supply energy at $18 per hp-year after allowing for all operating expenses, sinking fund and other incidentals.

On a later afternoon a party was shown over the plant of the Winnipeg Electric Company and many of them were impressed with the equipment of the substation for the distribution of energy throughout Winnipeg. A feature which seemed to interest many was the chart showing a peak load for the day previous of only 7,500 hp whereas the plant has a 27,000-hp equipment. They were shown the iron towers and high-tension rooms where the 60,000-volt wires enter from Point du Bois, 65 miles away. The circuit is then carried to banks of transformers with a secondary e.m.f. of 2,300 volts. From the secondary side of the transformers through busbars taps are taken off to supply the energy for Winnipeg. The lighting apparatus is capable of supplying energy to 150,000 incandescent lamps through seven smaller substations. In addition, energy is furnished for operating street cars in Winnipeg as well as some 40 miles of line outside the city.

## Gift to Institute Library.

The Western Electric Company has presented to the library of the American Institute of Electrical Engineers a most valuable addition in the shape of a patent specification library. This gift constitutes the largest accession since the original creation of the library by Dr. S. S. Wheeler with the Latimer-Clark collection.

The patent library which the Institute thus acquires contains no fewer than 461 substantial leather-bound volumes containing approximately 100,000 specifications. These specifications begin with May 30, 1871, and run to December, 1908, thus covering the entire period of activity which includes the telephone, the electric light, electric railways and the electric motor. From May 30, 1871, up to the last day of 1887 the volumes are complete, containing all the specifications issued by the Patent Department, certified. From July, 1887, up to Dec. 1, 1908, the volumes contain all the electrical specifications not certified.

The original set cost over $4,000, and duplicates of these specifications, if now purchased from the Government and bound, would cost between $4,000 and $4,500. This library has been accumulated by the Western Electric Company in Chicago, from which city it is now being brought to New York to be added to the rich collection of technical literature housed in the Engineering Societies Building. Mr. Edward Caldwell, chairman of the library committee of the Institute, has already taken the matter in hand as to proper care and installation of the library, so that the members may derive the greatest possible benefit from having such a collection at their disposal, and has also taken measures to complete the set to date. It is generally believed that this splendid contribution from the Western Electric Company will prove one of the most valuable accessions that the library could possibly have from the standpoint of practical utility, and that it will be likely to stimulate further generosity of the same kind. It is a most fortunate coincidence that the Institute had already been presented with a set of specifications antedating the period prior to those included in this gift.

## Condition of the German Electrical Industry in 1908.

Whatever may be the present condition of the German electrical industry, it is evident from compilations made by Dr. J. Einhart and published in the *Deutschen Wirtschaftszeitung* that the industry as a whole was very much at a standstill in 1908. Numerous causes are attributed to this condition, chief among which were the financial depression and harassing legislation. Sales in heavy electrical machinery were less than in the same period in 1907, and the motor output of four of the largest manufacturers for a number of years is shown in the accompanying table. The output of tungstens during 1908 being twice that of the previous year. The condition of the carbon industry was said to be satisfactory, while on the other hand electric vehicles fared very badly.

| | 1895. | 1900. | 1904-05. | 1906-07 | 1907-08 |
|---|---|---|---|---|---|
| Allg. Elec.-Ges. | 68,000 hp | 208,208 hp | 647,773 hp | 1,161,060 hp | 1,350,327 hp |
| Schuckert ..... | 39,460 hp | 267,350 hp | 964,115 hp | 1,060,150 hp | 1,014,225 kw |
| Lahmeyer ..... | ..... | ..... | 265,000 hp | 382,000 hp | 358,000 hp |
| Siemens & Halske ..... | ..... | ..... | 573,182 hp | 1,060,150 hp | 1,014,225 hp |

The difficulty of obtaining ready money except at high rates has led the larger companies to form banks or trust companies, two of which have already started, one by the Allgemeine Elektricitäts-Gesellschaft and Siemens-Schuckert Works with a capital of 30,000,000 marks ($7,500,000) and the other by Felten & Guilleaume-Lahmeyer Works with a capital of 25,000,-

000 marks ($6,250,000). The value of the bonds issued by both companies is three times the stock value. The trust companies are not regarded favorably by the Government.

| | 1895-6. | 1900-1. | 1905-6. | 1906-7. | 1907-8 |
|---|---|---|---|---|---|
| Allg. Elektr.-Ges. | 13 | 12 | 11 | 12 | 12 |
| Schuckert | 14 | 0 | 5 | 5 | 5 |
| Siemens & Halske | 10 | 8 | 10 | 11 | 11 |
| Lahmeyer | 5 | 11 | 7 | 7 | 7 |

Although the output during 1908 was somewhat restricted, the dividend did not fall off, as is indicated by the table herewith showing the dividend passed by four companies during five different years. Of 45 electrical manufacturing companies, having an aggregate capital of 573,000,000 marks, the dividend for 1906-1907 averaged 8.1 per cent, while in 1907-1908 it averaged 8.3 per cent. Stock quotations were as follows:

| | Jan. 2. | March 5. | Aug. 30. | Oct. 6. | Dec. 31. |
|---|---|---|---|---|---|
| Allg. Elektr.-Ges. | 196,— | 198,20 | 217,— | 223,— | 214,75 |
| Schuckert | 100,— | 103,20 | 107,— | 120,— | 115,70 |
| Siemens & Halske. | 171,— | 170,40 | 178,50 | 201,— | 205,50 |
| Lahmeyer | 121,— | 115,— | 119,50 | 122,20 | 117,— |

This shows that the companies are in a healthy condition. In 1908, 190,625 tons of copper were used as against 164,217 tons the previous year. The price of copper was also reduced. There were 180,000 tons of lead used by the electrical industries in 1908 as against 189,000 tons in 1907 and 185,000 tons of zinc and 15,000 tons of tin. The various manufacturers of insulating material combined in 1908 to keep up prices and as a result the cost of insulating material has increased from 50 to 200 per cent and over. The import and export of electrical material are given in the following table. The value of the exports of large electrical machinery increased over 50 per cent:

| | Imports. | | Exports. | |
|---|---|---|---|---|
| | 1908. Marks. | 1907. Marks. | 1908. Marks. | 1907. Marks. |
| Total electric products | 111,641,000 | 144,254,000 | 704,809,000 | 673,562,000 |
| (1) Machines | 70,182,000 | 83,194,000 | 420,692,000 | 387,272,000 |
| (2) Traction | 9,178,000 | 8,956,000 | 185,219,000 | 167,333,000 |
| (3) Other electric products. | 32,281,000 | 52,104,000 | 98,898,000 | 118,957,000 |

## The Edison Electric Light Convention.

The Association of Edison Illuminating Companies closed, on Sept. 2, a most successful convention, the general details of which were published in these columns last week. On the last day, the officers for the incoming year were elected as follows: Messrs. T. E. Murray, president; C. R. Huntley, vice-president; L. A. Ferguson, treasurer; executive committee: S. Insull, C. L. Edgar, J. W. Lieb, Jr., J. B. McCall, W. W. Freeman.

On Thursday evening a banquet was given in honor of Mr. and Mrs. Edison by the association in the large dining hall at Briarcliff Lodge. The room was superbly decorated and illuminated by the New York Edison Company, which took a rather cold and colorless room and turned it into an exquisite bower. In the ceiling all the holophote lighting was removed, and at each outlet baskets were put, the lamps and foliage being secured in the basket and flowers being clustered over all. From basket to basket streamers of flowers and foliage were suspended, all interspaced with lamps. All the columns were masked by wirework panels which in turn supported lamps and foliage and flowers in profuse abundance. All the corners were massed with light and color in the same way, and the entrance to the room was masked by a trellis, giving the effect of a flower garden. The center of the room was occupied by a huge table, oblong, and broad proportionately, built for the occasion, at which some 72 people sat. It was heavily banked with roses, ferns, etc., in beds of moss, and all through frosted lamps were concealed. Several thousand miniature and decorative lamps were employed in this scheme of illumination, which in itself was a felicitous and most beautiful compliment to the inventor of the Edison incandescent lamp. Special mention must be made of the intelligent and untiring work for the New York Edison Company of Messrs. Rhodes and Weissenberger, aided by Warendorf, the florist.

The dinner party included about 300, among whom were a number of Mr. Edison's early associates in the development of the great electric lighting art and industry. With these, whose names will readily suggest themselves, were several other special guests, such as President Cortelyou, of the Consolidated Gas Company; President Vanderlip, of the National City Bank, and Mr. A. N. Brady. The dinner itself was excellent, and the "exercises" were extremely interesting. The retiring president, Mr. W. W. Freeman, proposed the health of Mr. Edison as "a benefactor to mankind," and it went gloriously; but as a matter of fact the health had been drunk with musical honors all through the dinner; and later again each speaker in rhythmic succession gave the same toast. There seemed to be no other proper finale to a speech, and everybody was glad to have another chance at thus signalizing the sentiment of the hour. Mr. Freeman having done his modest share very adequately, turned the conduct of affairs over to Mr. Insull, as toastmaster, and he made good immediately. He spoke of Edison as the foremost inventor of his time, of the Anglo-Saxon race, a man whose name would live through all posterity. As to the lighting art itself, aside from the lamp and the dynamo, Edison's own financial support and help to the first station were part of his claim to honor, while the Edison system of distribution still remained dominant in the art. Mr. Insull followed his eloquent speech by presenting messages from Messrs. C. A. Coffin, T. N. Vail, C. Batchelor, R. R. Bowker, S. Bergmann, Elihu Thomson, John I. Beggs, N. F. Brady, Capt. W. Brophy and many others.

Mr. E. H. Johnson, former president of the Edison Electric Light Company, gave some intensely interesting reminiscences of the early days, and of his own acquaintance with Mr. Edison dating from 1870. He pointed out that the recognitions of Edison's work were, if anything, warmer abroad than in America, and that such men as the Lord Chief Justice of England and Lord Avebury hastened to do him honor. But great as was the intellectual capacity, immortal as was the product, Edison was "a man with a heart as big as his brain." Mr. Johnson was himself received with a burst of enthusiasm that must have warmed the very cockles of his own big heart.

Next came Mr. F. P. Fish, whose reminiscences were those of the representative of a once rival camp, and who took occasion to discuss the breadth and tolerance of Edison from that angle, citing also the intense admiration at all times expressed to him by Prof. Elihu Thomson of Edison's creative work. Mr. Fish referred to the lamp as not only a great invention, but "one of the greatest intellectual operations in the world," because Edison reasoned it out. And in like manner he had reasoned out other inventions applying different methods of attack to different problems.

Dr. C. P. Steinmetz made one of the happiest speeches of his life in trying to define Edison's position as an inventor, neither theoretical nor practical, but both in a great summation of intellectual and material achievement that placed his name in next and fitting sequence to those of Faraday and Helmholtz. Dr. Steinmetz pointed out how under changes of vast range the Edison fundamentals still persisted, and even as to the carbon lamp he saw qualities of permanence that did not inhere in even its latest rivals.

President-elect Murray was then inducted and made a quietly forceful speech in which he avowed that always registering at hotels, from Brooklyn, he more gladly did so since a fellow townsman had located the North Pole. He gave a pledge of loyalty to the high ideals of the association and then declared the close of the memorable convention of 1909—thirtieth anniversary of the lamp and thirtieth meeting of the body.

### MR. THOMAS E. MURRAY.

The new president of the Association of Edison Illuminating Companies, Mr. Thomas E. Murray, has long been one of the leaders in the electric light and power industry. He was born at Albany, N. Y., on Oct. 21, 1860, growing up in that city and taking very early to mechanical pursuits, his aptitude for which was supplemented by hard night study. While still a very young man he became engineer of the Albany Water Works, and about 23 years ago he was made chief engineer of the Electric Illuminating Company of Albany. His promotion as general manager soon followed, and while holding that position he acted as consulting engineer for the electrified street railway and lighting properties of Albany and Troy. When the lighting interests

in Brooklyn were consolidated in the Kings County Lighting Company's system, Mr. Murray was brought to Long Island to effect the physical merger of the systems; and about 11 years ago he removed permanently to New York City in order to carry out the even more responsible program of physical consolidation on Manhattan, a gigantic task performed so easily and smoothly the general public never knew it was in process of execution. Such work included not only the designing of the new Kings County Station, but that in New York—the Waterside—and this was followed by kindred work in designing the Third Avenue plant of the Brooklyn Rapid Transit and its large Williamsburg turbo-generator plant and all the substations. Incidentally, Mr. Murray designed also the plants at Albany, Troy, Rochester and Utica, being in all such work the man to whom the Brady interests owe so largely their extraordinary record for clever and successful mechanical engineering over a wide range of properties; and serving as another instance of that shrewd judgment of men always shown by Mr. A. N. Brady. From first to last, Mr. Murray has to his credit over 600,000 hp installed in some of the best plants America can exhibit. In all this work the preëminent qualities manifested have been clearness of vision and sanity of decision.

Mr. Murray has been interested in the Edison Association for about a dozen years, but has hitherto declined flatly to take office. He is also a member of the American Institute of

PRESIDENT THOMAS E. MURRAY.

Electrical Engineers, of the American Society of Mechanical Engineers, and of the National Electric Light Association. His vice-presidency of the New York Edison Company is but one of many similar positions held by him in the industry. Aside from his notable gifts as an engineer, Mr. Murray is also a versatile inventor, having at least threescore patents in various lines, such as cut-outs, fuses, seals, electric signs, electro-hydraulic elevators, etc., many of the articles being now manufactured in large quantities.

In 1887 Mr. Murray married Miss Katherine Bradley, daughter of the late Senator Bradley, of Brooklyn, and he now has a family of four sons and four daughters, two of the boys being at Yale and one at Georgetown. His happy family life is the only possible endorsement he acknowledges of Rooseveltian policy. Passionately fond of music, he has always cultivated it, and his associates and many a delighted convention audience know what the operatic stage lost when he devoted himself to the mechanic arts.

## Dielectric Stress in Three-Phase Cables.

A paper by Prof. W. M. Thornton and Mr. O. J. Williams, read at the Winnipeg convention of the British Association for the Advancement of Science, contained a description of apparatus employed in representing the dielectric stresses in three-phase cables by means of a mechanical analogue. Use was made of two circular glass plates 6 in. in diameter in one of which were bored three holes 3 in. apart placed equidistant about the center by means of nozzles and length of hose glycerine was allowed to flow from one or two holes and leave by way of the other two holes or one hole. The flow of glycerine was adjusted by screw clips on the discharge nozzles, so as to represent electrical conditions at 6 deg. time-intervals. Diagrams of the stream lines were obtained by photographing the model in use, projecting the photographs upon large sheets of drawing paper and sketching in the lines by hand. The dielectric stress was determined from the gradients of the stream lines.

## Three-Phase Charging Currents.

Prof. E. W. Marchant presented at the Winnipeg convention a paper, "The Calculation of Charging Currents in Three-Phase Cables," in which formulas were developed for expressing the current in terms of the electrical quantities and mechanical dimensions. The charging current per kilometer of wire in an aerial three-phase system with wires arranged at the three corners of an equilateral triangle, when expressed in amperes, is $E\omega \div (31.18 \times 10^6 \log \epsilon D \div r)$ where $E$ is the effective voltage between wires, $D$ the distance between wires and $r$ the radius of each wire $\omega$ being $2\pi f$. In a three-phase cable the maximum charging current per wire is $E\omega (2C_1 + C_2) \div \sqrt{3}$, where $C_1$ is the delta capacity between adjacent wires, and $C_2$ is the star capacity between each wire and the sheath. The value of $(2C_1 + C_2)$ is given directly by a ballistic test between one core and the other two connected to the sheath.

## Standardizing Electrical Equipment in Mining.

At the Pittsburgh, Pa., session of the American Mining Congress, held early in December last year, a resolution was adopted authorizing the appointment of a committee of seven persons to report back for the consideration of that organization means for bringing about the standarization of electrical equipment in mining and recommendations looking to uniformity in electrical practice in general. The resolution, which was introduced by Mr. David B. Rushmore of the General Electric Company, Schenectady, N. Y., was as follows:

"Recommended, that a standing committee be appointed by the president of the American Mining Congress, to standardize as far as possible and make recommendations concerning electrical practice in mining work, said committee to consist of seven members, an electrical engineer, two representatives of the manufacturers of electrical equipment, two representatives of the labor organizations and two mine operators."

In accordance with this resolution the following members have been appointed to serve on the committee: Dr. Edward B. Rosa, the Bureau of Standards, Washington, D. C., chairman; Mr. David B. Rushmore, General Electric Company, Schenectady, N. Y., representing the manufacturers; Messrs. J. R. Bent, Oglesby Coal Company, Oglesby, Ill., and George R. Wood, Pittsburgh Coal Company, Pittsburgh, Pa., representing the mine operators; Messrs. T. L. Lewis, president U. M. of A., Indianapolis, Ind., and James O'Connell, vice-president A. F. of L., Washington, D. C., representing labor.

While the committee has been so recently organized that not much work has thus far been accomplished, it will render a preliminary report to the next session of the Mining Congress, which will be held at Goldfield, Nev., Sept. 27 to Oct. 2. It will then continue its work and within the next few months will doubtless be prepared to complete its recommendations. As the absence of uniformity in the installations of electrical equipment in coal and precious metal mines has given rise to problems very annoying to operators and manufacturers, the work of this committee will doubtless be watched with interest. Those having any views to offer on this subject are invited to send them to Dr. E. B. Rosa, Bureau of Standards, Washington.

## Convention of New England N. E. L. A. Section.

The convention of the New England Section of the National Electric Light Association, to be held at Hotel Wentworth, Newcastle (Portsmouth), N. H., on Thursday and Friday of the present week, promises to be a successful affair. Very complete arrangements have been made for the entertainment of attendants, including a sail on the bay, a visit to the navy yard at Kittery, Me., and a banquet on Thursday evening. The ladies will, on Thursday afternoon, be shown about Portsmouth by guides provided by the Portsmouth Board of Trade, and on Friday will enjoy an automobile ride along the shores and beaches of New Hampshire.

At the general sessions on Thursday and Friday mornings the following papers will be read and discussed: "Advantages of Steam Heating for Electric Lighting Companies," by Mr. Charles R. Bishop; "Liability Insurance and How It Affects the Employer," by Mr. Walter L. Mulligan; "Low-Voltage Tungsten Lamps," by Mr. Frederick Welles Prince; "Hydro-Electric Development of the Connecticut River Power Company," by Mr. H. I. Harriman.

## Lake Tahoe Water Rights.

It is reported that the negotiations of the Hammon syndicate with the Truckee River General Electric Company and the Reclamation Service, previously noted in these columns, are at a standstill pending action by President Taft. Briefly summarized, the Hammon contract contains the following provisions: 1. Control of the land, but not the title thereto, at the outlet of Lake Tahoe. 2. Right to regulate the flow of water, provided it shall always be kept up to the requirements of the Truckee General Electric Company. 3. Privilége of paying half the expense of a new dam to replace the old one at the outlet of the lake. The Truckee General Electric Company is to receive: 1. The right to select without cost and to hold in perpetuity sites for reservoirs, right-of-way for flumes, ditches and transmission lines over the public lands within the entire watershed of Lake Tahoe and the Truckee River. 2. Privilege of making these selections over a period of five years. 3. Right to make new power developments from the waters of Tahoe. 4. Authority to cut a tunnel from the northeast corner of the lake over into Lake Washoe.

## Direct-Current Line Corona Losses.

At the Winnipeg convention of the British Association for the Advancement of Science a paper entitled "Atmospheric Loss of Wires Under Direct-Current Pressures" was presented by Mr. E. A. Watson. The author reported the results of tests similar to those conducted by Messrs. Mershon and Ryan in this country, but using direct current instead of alternating. The tests made to determine the effect of changes in barometric pressure upon the critical voltage at which loss commences and the relation between the critical stress and the wire diameter agreed substantially with Prof. H. J. Ryan's results, and showed that the voltage of formation of the corona is very nearly the same whether the stress is alternating or steady, provided in each case the maximum value and not the effective value be taken.

As a result of his tests, the author concluded that there is a definite critical stress for which loss occurs from a direct-current line just as from an alternating-current one; the direct-current stress required to produce this loss is the same as the maximum alternating-current one, and it is substantially the same whether the wire is positive or negative, provided that it is clean, as for dirty wires the electric stress is lowered much more for negative than positive charges; the critical stress is greater the smaller the wire diameter; the critical stress is reduced by a reduction of the air pressure, but not proportionally; the presence of water vapor in the air does not affect the loss or critical stress for a clean wire—an actual transmission line does not behave exactly like a perfectly clean wire, and the loss is affected by the presence of water vapor in the atmosphere.

## Conservation of Resources.

At the noonday meeting of the Electric Club, in Chicago, Sept. 1, Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, gave a talk on "The Conservation of Resources," thus putting the club in line with other professional bodies in the discussion of this political and economic topic. Unlike most speakers on the subject, however, he did not deal in glittering generalities, but announced that he had a plan which far transcended anything heretofore proposed in the way of forest preservation. This consisted in increasing the amount of carbon dioxide in the air, thus encouraging vegetation, which would cause our depleted forests to rise rapidly again and force barren places to become productive. Taking up details, he solemnly elaborated a scheme for the production of carbon dioxide by burning the useless fuel which is now going to waste under the surface of the earth. He would require all coal-mining operators before abandoning a mine to set fire to the coal which could not be mined and keep this burning by means of forced draft. He would also open up some of the thin veins of coal which are not of good enough quality to mine for fuel. In this way, he thought, that the present consumption of coal, amounting to about 1,000,000,000 tons of coal a year, could be increased to 500,000,000,000 tons, which might sufficiently enrich the air with $CO_2$ to accomplish the desired results. Mr. W. S. Taussig inquired how long it would take to accomplish these results with our present rate of coal burning. Mr. Abbott replied about 2000 years. Mr. E. N. Lake asked whether Mr. Abbott had elaborated any scheme for producing electrical energy along with this scheme for utilizing coal. Mr. Abbott said that it had been suggested that these thin veins of coal be operated as gas producers supplying carbon monoxide to gas engines, these engines to produce electrical energy. Fortunately, no one was unkind enough to ask Mr. Abbott whether he was conscientiously trying to do his share in increasing the carbon dioxide in the air by burning as much coal as possible per kw-hour in the great electric generating plants which are under his charge.

## High-Frequency Oscillations.

At a meeting of the Wireless Institute, held on Sept. 1 at the Engineering Societies Building, New York, Mr. Harry Shoemaker presented a paper entitled, "The Production of High-Frequency Oscillations." The author outlined the characteristics of damped and sustained oscillations and stated that, while the latter are used for wireless telephony, the former are employed almost exclusively for wireless telegraphy. Damped oscillations are produced in practice by the discharge of a condenser across a spark-gap through an inductive circuit. The period of the oscillation depends upon the product of the capacity of the condenser and the inductance of the circuit. The antenna may be directly connected to the exciting circuit or it may be inductively associated therewith. In practice use is frequently made of a combination of the two connections. The ratio of the mutual inductance to the square root of the two self-inductances is known as the coupling coefficient; it may be as low as 0.1, but is usually about 0.2. Best results are obtained when the natural period of the antenna circuit is the same as that of the exciting circuit. Energy stored in a condenser during each cycle has a value proportional to the product of the capacity and the square of the voltage; the power utilized varies directly with the number of cycles per second. It is found that a 0.0075-mf condenser requires 1 kw when operated at a frequency of 60 cycles and an e.m.f. of 20,000 volts. Five kilowatts are used when the frequency is 120, the capacity 0.03 mf and the e.m.f. 28,000 volts.

In a conversational discussion following the reading of his paper, the author remarked that the best form of antenna is a straight wire mounted in the vertical plane. Energy for the condenser in the exciting circuit is obtained from the secondary of a transformer constructed with a large amount of magnetic leakage so that the current remains practically constant from full load to direct short circuits. On account of the leading condenser current the actual, secondary e.m.f. is much greater than the value found by multiplying the primary e.m.f by the ratio of turns. Moreover, the e.m.f. per turn is not uniform throughout the secondary coil, being greater at the end-turns.

## Government Power Plant at Washington Nearing Completion.

The electrical power station on Capitol Hill, Washington, is almost complete and when fully equipped for the purpose of its construction will cost almost $2,000,000. The station, which was described in our issue of June 1, 1907, will supply light, heat and power for the office buildings of the House of Representatives and Senate, the Congressional Library and the Capitol. It is located near the Capitol in Garfield Park near the intersection of Virginia and New Jersey avenues, southwest. The station is connected with the legislative group of buildings mentioned by tunnels through which steam pipes and cables run. The tunnels are large enough to permit a man to walk through them so that breaks and other troubles can be quickly located and repaired. The tunnels are over 7000 ft. long in the aggregate. The cornerstone of the power station was formerly the base stone of the Greenough statue of Washington which stood for many years on the plaza of the east front of the Capitol and was recently removed to the Smithsonian Institution.

## Electric Rates Reduced by Boston Suburban Consolidation.

The Edison Electric Illuminating Company of Boston assumed charge of the electrical business of the suburban companies in Waltham, Newton, Watertown, Brookline, Brighton and Chelsea on Sept. 1, in accordance with the recent decision of the Massachusetts Gas and Electric Light Commission authorizing the purchase of these companies by the larger organization centering in Boston. Except in Newton and Watertown the change introduced reductions in rates from 16 cents to 12 cents per kw-hour, or 25 per cent. In Newton and Watertown the rates were reduced from 18 cents to 12 cents per kw-hour early in the present year, when the assumption of the business by the Edison Company was anticipated. The Massachusetts Gas Companies have controlled the gas business of the above-named companies for some time, and the taking over of the electrical service by the Edison Company enables each service to be pushed to its most effective limit.

A feature of the new arrangement is a 10-year contract which the Edison Company has made to supply power to the electric railway lines controlled by the interests which have operated the Waltham Gas Light Company. These roads include the Lexington & Boston, the Natick & Cochituate, the Newton, the Newton & Boston, the Middlesex & Boston, the Westboro and Hopkinton, and the Newtonville & Watertown. For several weeks these lines have been using power supplied by the Edison Company, and the steadiness and efficiency of the supply have created a favorable impression. There will be no interruption in the lighting and power service of the customers of the suburban companies which have been taken over by the Edison system, the transfer being largely a matter of business details. In Waltham a turbine station of about 1200-kw capacity has been taken over by the Edison Company, and in Chelsea the service has for some time been supplied from the Edison system, as has been the case in Newton and Watertown. It is expected that the Allston plant of the Boston Consolidated Gas Company, which formerly supplied Brookline and a part of Brighton, will be taken out of service as soon as possible, as it is not of modern design and cannot be operated at first-class economy of production with its present equipment. All the service of the suburban communities now a part of the Edison system will be centralized at the L Street station of the company in South Boston.

## Idaho Water-Powers.

Under date of Aug. 30, Mr. William E. Curtis contributes from Idaho an interesting letter to the Chicago *Record-Herald* giving an account of the great water-power resources of that State. The Snake River, which, he says, has been called "The Jugular Vein of Idaho," runs 800 miles through the State and drops between 5000 ft. and 6000 ft. during its circuitous course between the boundaries of Wyoming, where it rises, and Washington, where it flows into the Columbia. It irrigates, with its tributaries, more than 3,000,000 acres of land, and its tremendous current has energy enough to turn all the wheels that are revolving in the United States to-day.

This valuable property has been gradually absorbed by corporations from California, Colorado, Illinois, Pennsylvania, New York, Massachusetts and other States, as well as by local individuals and syndicates, chiefly for speculative purposes. But there is, he says, no evidence to be found to sustain the contention that there is any collusion or understanding, much less a partnership between the interests represented. Nor is there any evidence, or even a ground for suspicion, that the General Electric Company, or the Westinghouse Company, or any of the great corporations of the East are behind the movement, as has been so frequently alleged. On the contrary, the people who are getting hold of the power sites are either local electric light and power companies, who wish to utilize the energy that is going to waste, or speculators who desire to obtain control of available sites in order to make a profit by selling out to companies which may be organized in the future to utilize them.

Nobody in Idaho believes, he says, in the alleged water-power trust. There is more evidence of rivalry and even hostility among the interests that hold the claims. "Instead of collusion there is a grand scramble to secure a share of the wonderful possibilities represented by the Snake River and its tributaries purely as a gamble on the future. There is nothing whatever to justify the assertion that these claimants are filing in the interest of other persons. Those who are familiar with the affairs of the General Electric and Westinghouse companies and similar corporations know that water-power sites, more or less valuable, in different parts of the country are offered to them every day, usually for fabulous prices, based upon the President's message, the report of the conservation commission and the popular impression that a water-power trust is grabbing everything it can reach.

"Water-power sites can be acquired under the laws of Idaho by filing an application and paying a fee, provided they have not already been located. These applications are granted by the officials at Boise City upon the stipulation that the power is to be utilized in good faith, and the locator must do a certain amount of work within a certain limit of time. If he has a market, he usually organizes a stock company, floats bonds enough to pay for a plant and sells light and power to the public. If the applicant is merely a speculator he "puts up a bluff," and when his legal rights expire he arranges for a partner or a friend to make a filing on the same location before he relinquishes. By repeating that process a syndicate of speculators can control the water-power site for a number of years, but if the power is needed for any practical purpose it fights for control or sells out to those who would make practical use of it.

"Within a radius of 90 miles of Boise there is not less than 100,000 hp awaiting development, but all of the available sites have been taken up by individuals and corporations which are well known and do not represent any monopoly East or West.

There is no collusion between them. They have no relations whatever and have conflicting interests. This water-power represents several million dollars worth of coal annually to Boise City, and the optimists of this section are confident that the time will soon come when it will be needed and used for practical and profitable purposes. There is no manufacturing here now. There is no possible use for this power, but there are plans for electric mills to grind the wheat into flour, for factories to spin and weave the wool from the sheep that graze upon the mountain sides. There are plans for mills to manufacture breakfast foods and other patent 'cereals'; and engineers who are thoughtful enough to grasp the situation recognize that a considerable part of the energy of the Snake River will be needed in a few years to pump its own water into irrigating canals at higher levels than can be reached by the ordinary flow."

A number of power plants are already being operated by corporations in Idaho, most of them controlled by outside capital. A notable exception is the plant at American Falls, on the Snake River, 25 miles west of Pocatello, which is owned entirely by Governor J. H. Brady. It present capacity is 4000 hp, which can be increased to 60,000 hp. Near Mountain Home, 50 or 60 miles east of Boise, a Canadian syndicate has undertaken the development of 30,000 hp, and has contracted to furnish 7500 hp for lighting and manufacturing purposes by April 1, 1910. At the town of Rupert the United States Government is preparing to develop 12,000 hp to pump water for irrigation purposes. Mr. H. L. Hollister, of Chicago, has a 10,000-hp hydro-electric plant at Shoshone Falls, which distributes electrical energy over a large area at prices so low that farmers can use it for every kind of purpose. These falls, which are stated to have a power capacity equal to Niagara, are owned by ex-Senator W. A. Clark, who is said to be waiting a proposal for their purchase. Forty miles further down the canyon, at Lower Salmon Falls, near the town of Hagerman, the Kuhn Brothers, of Pittsburgh, are building a dam for irrigation and power purposes which will create a lake 13 miles long, and will impound water enough to irrigate 120,000 acres of land, and will furnish power for electric light and traction. Five miles from Hagerman are the Upper Salmon Falls, held by an Eastern company, which are capable of furnishing an equal amount of power.

## New York Public Service Commission News.

A committee of the Twenty-third Street Improvement Association, which is composed of property owners and merchants in the vicinity of Twenty-third Street, Fourth, Fifth and Sixth Avenues, has presented to the Public Service Commission of the First District of New York plans for amending the proposed Broadway-Lexington Avenue route for a new subway by including a loop which will leave the line at Broadway and Tenth Street, continue up Broadway to Thirty-first Street, thence west to the new Pennsylvania Railroad Station at Seventh Avenue, and under that thoroughfare to Times Square. This plan, it is claimed, will give a Broadway line from end to end and will connect the new station with both the present and the proposed subways. Immediately after these proposals were made known the Bradley-Gaffney-Steers Company, which has announced its intention of bidding on the Lexington Avenue route, expressed its willingness to conclude the loop in its bids.

Members of the Public Service Commission had the first of a series of conferences last week with President Shonts and General Manager Hedley of the Interborough Rapid Transit Company. These conferences are for the purpose of arriving at some sort of an agreement between the commission and the Interborough as to new subway routes.

An investigation was begun last week into the reasonableness of a three-cent fare across the Williamsburg Bridge, as charged at present by the Bridge Operating Company. It was shown at the hearing that the total tangible property of the company is only $100,764. The hearings will be continued Sept. 9.

The Public Service Commission, Second District, has authorized the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company to deliver and execute to the West End Trust Company, of Philadelphia, a mortage to the amount of $2,500,000, to be executed under and by the corporate name of Geneva & Auburn Railway. The corporation is authorized to issue at present $500,000 5 per cent, 30-year bonds to be sold at not less than 90. Four hundred thousand dollars of the proceeds are to be used for the discharge of the outstanding bonds of the corporation and $100,000 for the acquisition of property and extension and improvement of facilities of the corporation. Among the improvements are an extension to Cayuga Lake, costing $50,000; four new cars, costing $36,000; temporary power house, $7,728; new turnouts, $4,509, and a "Y" at Seneca and Exchange streets, Geneva, $4,002.

The Elmira Water, Light & Railroad Company has been authorized to issue its first consolidated 5 per cent 50-year gold bonds to the amount of $196,000, to be sold at not less than 85. Of the proceeds of the sale $59,874.17 is to be used for the payment and discharge of indebtedness incurred in constructing additions and betterments to its property, and the balance for future additions and betterments.

The commission has authorized the Patchogue Electric light Company to exercise franchises to furnish light for public and private use, granted it by the town of Brookhaven, L. I.

The Public Service Commission, Second District, has completed its investigations and examinations of the applications made by the Associated Gas & Electric Company for the readjustment of its financial affairs by the issuance of new mortgages and bonds. Action was taken some weeks ago and orders issued in relation to the Newark, Penn Yan, Hornell and Norwich companies. After hearings and conferences with the applicants and their attorneys, King, Waters & Page, of Syracuse, final orders have just been issued in the cases of the Ithaca, Homer and Cortland, Palmyra, and Lyons companies.

The Ithaca Gas Light Company applied for authority to make a mortgage for $750,000, but afterward amended its petition and asked that this amount be placed at $400,000. The company is authorized to issue the mortgage to the amount of $400,000 and at this time bonds thereunder to the amount of $260,000 in 5 per cent, 40-year bonds to be sold at not less than 90. The proceeds of these bonds are to be used as follows: $200,000 to refund outstanding bonds, $27,400 for the discharge of certain obligations and the remainder for betterments to the plant and distributing system of the corporation. Authorization is made upon the condition that the mortgage shall contain a provision for creating a sinking fund for the amortization of the bonds to be issued under this mortgage. Each year until the bonds mature an amount equal to one-half per cent of the aggregate amount of the bonds shall be paid to the trustee, who will apply this money for the redemption of the bonds at a price not to exceed 105. The mortgage shall also contain a provision that the company will pay over to the trustee each year not less than 40 per cent of the net corporate income of the company until this shall amount to $90,000. The trustee may from time to time pay to the company a whole or any part of this fund to be used for additions and betterments to the plant and distributing system of the corporation. When the investment fund shall have amounted to the sum of $90,000 it shall all be turned over to the company to be held by it without further condition or limitation. Further provision is made that a further sum of $20,000 shall be raised after the $90,000 has been secured to be used in the same manner.

The Lyons Gas Light Company applied for permission to issue a mortgage in the sum of $150,000 and thereafter amended its petition to make the mortgage $100,000. Permission was given to execute a mortgage in the latter sum and the issuance at this time of $50,000 in 40-year 5 per cent bonds to be sold at not less than 85. Of this amount $34,000 is to be used for the discharge of obligations and $9,600 for the construction of a new high-pressure gas main.

The Homer & Cortland Gas Light Company originally applied for a mortgage in the sum of $500,000, but afterward amended its petition and asked that this amount be placed at

$250,000. The commission authorized the latter amount and at this time granted permission to the issuance of $160,000 in 40-year 5 per cent bonds to be sold at not less than 90. Of this amount $100,000 is to be used to refund outstanding bonds, $39,750 for the payment of certain obligations and the remainder for additions and betterments to the plant and distributing system.

The Palmyra Gas & Electric Company is authorized to make a mortgage in the aggregate sum of $100,000 and to issue at present $60,000 in 40-year 5 per cent bonds to be sold at not less than 90.

In the Lyons, Homer and Cortland, and Palmyra applications provision is also made for sinking funds to provide for final wiping out of items which the commission did not deem the proper subject of capitalization, and sufficient time in each instance is given to allow the companies to put their affairs in shape desired by the commission and also to allow them to proceed with the proper service to the public and making of necessary improvements.

The commission will hold a meeting on Tuesday at Port Jervis to hear a proposition to be submitted by C. F. Wright, E. P. Emerson, I. N. Beardslee, C. Richard Taylor and Frank R. Moody, who have been granted franchises by the Common Council of the city of Port Jervis, for furnishing gas and electricity and operating an electric railway in that city. For a long time back there has been complaint of the lighting and street surface properties in that city. The old company is now undergoing reorganization and the reorganization committee has an application pending before the commission for the refinancing of the existing properties in that city. On Wednesday, at Albany, the commission will hear the application of the Economic Power & Construction Company for approval of its franchises which it is now exercising in the city of Geneva. The granting of the application will be opposed by the Geneva-Seneca Electric Company, one of the companies of the General Electric Company. On Friday will be heard, at Buffalo, the complaint of the Buffalo General Electric Company against the Prudential Building Company relative to the alleged unlawful rendering of electric service without the authority of the commission, the complaint of residents of the town of Amherst against the Buffalo & Williamsville Electric Railway Company relative to the fares on that road, and the complaint of various other patrons of the Buffalo & Williamsville Electric Railway Company as to service rendered and lack of accommodation.

The commission has authorized the Babylon Electric Light Company to issue its capital stock to the amount of $30,000 for the payment of various indebtedness outstanding against the company.

## Methods of Wisconsin Commission for the Valuation of Public Utilities.

The Wisconsin laws affecting public utilities provide that the Railroad Commission of the State "shall value all the property of every public utility actually used and useful for the convenience of the public." It is also provided by law that the commission, in making the valuation, may avail itself of any information in possession of the State Board of Assessment. The reason for this latter provision arose in part from the fact that the Railroad Commission and the Board of Assessment for several years have been served by a joint engineering staff, at the head of which is Prof. W. D. Pence, engineer for the two commissions. The importance of the attitude of the Wisconsin laws toward the subject of valuation is further indicated by the provision that the Railroad Commission can make a revaluation, at any time, on its own initiative.

Valuations made by the engineering staff for the Railroad Commission are considered in the decisions of the commission concerning rates charged for public-utility services and are, therefore, matters of vital concern to the utility corporations of the State. It is understood that the position of the commission is that the valuations at which the engineering staff arrives constitute evidence for consideration in all proceedings bearing on the adequacy of rates. As submitted by the staff, the valuations are regarded as somewhat tentative and subject to revision always if the justice of change is made plain.

Ordinarily, in making a valuation, a complete inspection of all the physical property of the corporation is undertaken and every effort is made to ascertain original costs and to determine particularly in what manner and to what extent values are affected by conditions that are peculiarly local. The staff is so organized that the principal branches of the work are referred to different heads of departments, who, with their assistants, make complete reports, which, when combined, form the basis of the final conclusions embodied in the tentative valuation submitted to the commission.

Professor Pence, in discussing the advisability of regarding the valuations reported by the staff as tentative, stated that while it is believed that the methods followed yield the fairest estimates obtainable, precedents have to be created in many instances and, therefore, neither the staff nor the commission is willing to regard these valuations as necessarily conclusive until a final decision in each case is rendered by the commission.

Heads of the various departments of the engineering staff principally concerned in the work of valuations explain the methods followed, as indicated below.

### OVERHEAD EQUIPMENT.

Mr. W. F. Sloan, who has charge of the field inspection and estimates of overhead and telephone equipment, said that in most cases actual field inventories of the physical property are made. In the valuation of the railway property of the Milwaukee Electric Railway & Light Company, however, it was found that the records of the company were nearly complete. The valuation staff, therefore, secured the company maps and copied the official records and checked the equipment in the field by inspection. In this case, the staff did not inspect by personal visit all of the apparatus and equipment. Over 90 per cent of the overhead work and over 10 per cent of the manholes were inspected personally by members of the staff. The intent was that the staff should be assured by actual inspection that the records of the company were substantially correct, and enough field work was undertaken to substantiate this fact. With the other properties in the State, which are all smaller, the practice is to plot the location of the poles on large insurance maps. In valuing the wiring, 80 per cent is allowed for copper and 20 per cent for insulation. During the inventory of properties through the State interesting facts were learned bearing on the average life of different units. By digging down 6 in. or 8 in. below the surface, the staff inspected various poles carefully. As a result of this inspection, extending to practically all parts of the State, an extreme variation of 10 to 20 years in the life of wooden poles is assumed, but the average is about 12 to 18 years. Due to conditions peculiar to certain localities, it was found that poles in one community had a very short life, and in another a life far in excess of any which the staff had been justified in assuming as normal. The dates of purchase and installation of the poles are secured in each place.

In valuing telephone properties, an inventory of the overhead equipment is made in about the same manner as that followed for electric lighting and power overhead equipment. Dates of purchase of telephone apparatus and all other available information bearing on the cost or life is secured.

The staff making these valuations has endeavored to ascertain, as far as possible, the scrap value of the material and the approximate minimum percentage of value at which service could be maintained profitably. The staff determines the service value of the equipment, estimating the age, if not known.

### BUILDINGS AND OFFICE EQUIPMENT.

Mr. R. M. Fuestel has direct charge of the field inspection of buildings and office equipment. In making valuations of these classes of property, the practice is to sketch a plan of the power station, showing the inside dimensions, and to prepare absolute contractors' estimates covering all parts. The contractors' profit is figured on each item. Local costs and profits on mate-

rials are taken into account on each unit in the different communities. The practice is to take the cost of reproduction of buildings new and then tentatively depreciate the same according to a 4 per cent sinking-fund curve; but in the final calculation the staff relies more on the facts than on the figures developed by any other means. The general practice of the engineering staff of calculating a five-year average price for each unit is not followed altogether in the valuation of buildings and office equipment. In this case, a two-year average price is applied to almost all building materials, except steel work, for which a five-year average price is calculated. The first change from the general rule of the five-year average price was made in computing the cost of lumber, and there has been no contest on the action of the staff in adopting two-year average prices for materials of this character. A complete inventory is made of office furniture.

The custom, in starting the work of valuation, is to interview reliable contractors in the community, getting such information concerning the local costs of labor and materials and conditions affecting building as they are willing to give. No serious difficulties have been met in securing this information. The following lives have been assumed usually, although there are variations from these figures:

| | Years. |
|---|---|
| Average brick structure | 50 |
| First-class stone and concrete structure | 75 |
| Frame passenger station | 35 |
| Coal sheds and outbuildings | 20 to 25 |

No scrap value is figured in the majority of the buildings. It is considered that when they are torn down the cost of wrecking would absorb any value that might be left in the material. In the inspection and the final determination of the life of the structure the practice which the management has followed as to maintenance of the property is given proper consideration.

### POWER STATION AND ROLLING STOCK EQUIPMENT.

Mr. R. W. Harris, who has direct charge of valuations of rolling stock and electric power station equipment, stated that in valuations of rolling stock the first step was to learn how many cars were owned by the company and then to inspect them thoroughly. If possible, a ride is taken on every car. After this is done, a study of the methods of maintaining the cars is made. Shop methods are observed carefully, and especially the method of washing the cars. A photograph is taken of each type of car and a statement made of the estimated life and minimum service value of the different types. The various parts of the car and equipment have been found to depreciate at different rates. The life of a truck is assumed to be 20 years, and of a car body 15 years. Railway motors of modern types are allowed a life of 20 years, and of obsolete types, 15 years. The minimum service value of a modern type of car is assumed to be 35 per cent of the cost value new, and of an obsolete type, 20 per cent.

When valuations of power-station equipment are made, a detailed inventory is drawn up, covering the complete plant. Every machine is inspected. The name-plate data are taken. The statistical record compiled for every machine gives the age and goes particularly into the conditions of maintenance. Every unit is assumed to be in good, fair or poor condition. "Good" condition represents standard maintenance. "Fair" is 10 per cent less than "good." If a machine is badly run down and very much overloaded, the report calls the maintenance "poor," which means 20 per cent less than "good." After all the machines are inspected and the desired information obtained, a similar course is followed with the switchboard. After the data relating to the switchboard have been secured, a sketch is made of the buildings. When the complete inventory of the power-station equipment has been completed, the staff returns to the office of the company undergoing valuation and places a value on each individual piece of apparatus. In fixing these prices it is believed that average conditions are secured by following the general practice of the staff in calculating five-year averages. After fixing the five-year average value, the final price, which may involve some deviation up or down from the average value, is reached. Various conditions of actual purchase may have an effect on cost value that may cause marked deviation in the final price adopted. After the contract or original value is secured, and the various elements affecting price are considered, the present value is fixed. The cost value as calculated includes the cost new and the freight plus the expense of installation. In figuring the present value use is made of the unit cost minus the scrap value, leaving the wearing value to be depreciated according to age and conditions of operation.

### MECHANICAL.

Prof. J. G. D. Mack, chief mechanical inspector of the commission, has under his direction the valuation of mechanical equipment and material. Forms are provided so that a complete inventory may be made of the mechanical apparatus if used by any one who is not familiar with the property. It is necessary that the inventory shall be so made that the equipment may be traced by the description on the form. It is considered that inspectors will not be able to compute the present value to within 10 per cent of the true condition. Books are provided in order that the inventory of the piping may be made complete. Thirty per cent is usually added to the cost of piping, new, as calculated, to cover the expense of freight and erection.

### BUILDING SITES AND RAILWAY RIGHT OF WAY.

Mr. W. E. Miller, assistant engineer and office engineer, said that in valuing the right-of-way of electric railways the practice is to make a map of the property by towns and to send to the county seat and ascertain the assessment of similarly situated lands by the latest tax rolls available. Usually this assessment was made one year prior to the one in which the valuation is prepared. From this data the assessment for a certain strip along the line of the road is learned. From the total acreage and the total assessed value in certain adjacent strips of lands the total assessment value per acre is derived. The records of the State Board of Assessment give the assessment ratio based upon exhaustive field investigations of actual transfers for the year, and then the average assessed value per acre is divided by this ratio and the result is assumed to be the true market value per acre based on sales for the year in the assessment district. The cost of acquiring land used for railway right-of-way is assumed to be 2½ times the local value for farming purposes; and by multiplying the true market value per acre, as ascertained in the manner outlined, by 2½ the result for valuation for railroad purposes is given.

The following illustrations indicate the practice followed in making valuations of right of way for railways. By 11 transactions land aggregating 9.93 acres was purchased for a consideration of $1,750, making the average price per acre to the railway $176.13. The assessed value of land aggregating 1676.59 acres, used for farming purposes and located on both sides of the railway, was $110.565, or an average of $65.93 per acre. From the records of the statistician of the State Board of Assessment the assessment ratio was ascertained by which the staff was able to find the assumed real value per acre. By dividing the assessed value by the ratio, the true value for ordinary purposes is ascertained. Thus, $65.93 is divided by 0.793, giving $83.14. The latter figure, it was held, represented the true value of land in that district for farming purposes as determined by farm sales. To this value was applied the ratio of 2½ already mentioned. Since the railway company in this case paid $176.13, its land cost about 2⅛ times the nominal market value obtained in the manner above outlined. In another similar instance there were seven separate transactions for land aggregating 10.88 acres used for right-of-way purposes. The total cost was $1,785, and the average price per acre $164.36. At approximately the same time it was found that the assessed value on the tax rolls for 2526.75 acres was $160,770, or an average per acre of $63.62. The records of the State Board of Assessment showed an assessment ratio for the district of 86.78 per cent. By dividing $63.62 by 0.8678 the real market value per acre was ascertained to be $73.32. In this case it is known from the company's records that it actually paid $164.36, so that this land cost about 2¼ times the market value. The two instances here

cited chance to show ratios less than 2½, which latter ratio was derived from extended investigations over the entire State.

In making valuations of land used for location of power stations and like purposes a diagram is usually drawn showing the total value of real estate in the city in question from 1901 to 1907, inclusive, for instance. If the tax rolls are not made out for 1908, the value of all land in the city is determined from the summary of values of real estate found in the tax rolls and from the corresponding assessment ratios. The value of all the land in the city is learned and these values are reduced to diagrams. There has been almost a uniform upward tendency in the value of real estate in the communities of Wisconsin, and, therefore, it is assumed by the engineering staff that real estate continued to rise in value in 1908 at the same general rate as during the several preceding years. Unless evidence to the contrary is found, it is assumed that the value of all the real estate throughout a city, and, therefore, of the tract under investigation, increased in the same proportion; for example, in one specific instance, where the calculation was made by this method, it was determined that the 1908 value would be 9.1 per cent more than in 1907. The figures in the method outlined apply only to land for improved real estate and to unimproved land, a separate valuation being made for the buildings. After the value is fixed in this way from prices of surrounding lots it has been the usual practice, in valuing large tracts, to add 10 per cent for the extra cost of acquiring the property in small pieces to bring it under single ownership. There is variation from this practice in the valuation of private right of way for railroads in large cities. For property of this kind 10 per cent is usually added for the larger tracts of land and 33 1/3 per cent for strips of 100 ft. in width or less.

The members of the staff whose names are given in the foregoing article have all had experience in railway or other public-utility properties, and some of those mentioned had experience in important appraisals of large properties prior to their connection with the staff. A complete set of printed forms have been provided for use by the staff in collecting and tabulating the data for the valuations.

## CURRENT NEWS AND NOTES.

*METER TEST REPORTS.*—In the article, Public Service Commission hearing in New York on meter test reports, published in the Aug. 26 issue, it was stated that "direct-reading indicating wattmeters shall be used as standard instruments in making tests of consumer's meters." The regulations are to the contrary, the word "not" having been omitted after the word "shall."

*STORAGE BATTERIES IN AUSTRIAN CENTRAL STATIONS.*—Of 367 direct-current central stations in Austria, no less than 229 employ storage batteries, the total battery capacity being 10,225 kw. There are only 173 alternating-current stations in the Empire, including 21 stations generating both alternating and direct current, which latter have 9553 kw in storage batteries installed.

*MUNICIPAL ENDORSEMENT OF NATIONAL ELECTRICAL CODE.*—The city of Rifle, Col., has passed an ordinance requiring National Electrical Code construction within the city, with the additional requirements that there shall be 6 ft. spacing between high-tension and low-tension wires, that in buildings, cabinets shall in all cases be installed, and that secondaries shall be grounded effectually.

*ELECTRICITY FOR BLEACHING.*—The Amazon Knitting Mills, of Muskegon, Mich., is using an electrolytic process for the production of the bleaching solution required in its factory. The cells are of a type employed in laundries heretofore and were made by the National Laundry Machinery Company, of Dayton, Ohio. The cost of bleaching is stated to be less, and the uniformity of results much better since this process was put in operation at the Amazon mills.

*ELECTRIC BELLS ON LOCOMOTIVES.*—The Indiana Railroad Commission has issued a circular calling the attention of steam railroads to the recently enacted law which provides that after Jan. 1, 1910, all locomotives used on their lines shall be equipped with efficient automatic or electric devices for ringing the bell on such locomotives, and that it is made the duty of the commission to enforce the provision of the law.

*EUROPEAN TRACKLESS TROLLEYS.*—Our issue for Aug. 19 contained an article entitled "European Trackless Trolley Cars," in which certain estimates were given for the working expenses. The values stated should have been expressed in cents instead of dollars. Thus, the cost in the case of the Mercedes-Stoll system was 9.04 cents per car-mile and not $9.04, and that of the Filovia system 11.29 cents and not $11.29.

*NINE MILLION-HP CANADIAN DEVELOPMENT.*—The minimum-flow development of all the water-powers of Canada, according to Mr. J. B. Challies, of the Canadian Department of the Interior, is estimated at over 25,680,000 hp, of which about 516,900 hp has as yet been utilized. Hamilton River, in the Labrador Peninsula, is the largest available power, with a possible development of 9,000,000 hp, Niagara Falls being second to it.

*THEORY OF EARTH'S MAGNETIC POLE.*—The discovery of the north pole is followed by a letter in a Rochester daily newspaper disclosing the discovery of the cause of the effect of the earth's magnetic pole on a magnetic needle. "The cause of the magnet needle," the writer says, "can be readily explained by the theory that the heat from the molten mass of the earth's center and the intensely cold water cause steam. Then the motion of the globe causes a whirlpool of the vapor that rushes forth from the hot center. Why, then, heat, cold, moisture and friction—it's what? Why, magnetic. And the vapor spreads out and forms into an ice belt that encircles the globe around the North Pole or Arctic Ocean, where the vapor whirlpool is located." The writer's manner of begging the question is unique.

*TELEPHONES IN THE TRANSVAAL.*—Numerous extensions and improvements are planned for the Transvaal telephone system. It is reported that every town not yet linked up with the telephone system is to be brought into it, and the main trunk lines are to be carried to every point where the railway lines cross the border, with a view of preparing the way for the ultimate extension to the coastal ports and Buluwayo. It is regarded as certain that the Union Government will find telephonic communication between Cape Town and Pretoria absolutely essential under the proposed arrangement by which Parliament will meet at a place so far removed from the administrative center. The scheme contemplates connections with farmhouses and the establishment of call offices at convenient centers in rural districts. It is estimated that the coast extensions definitely undertaken will cost $1,250,000.

*PERPETUAL MOTION BEFORE THE B. A.*—At the Winnipeg meeting of the British Association for the Advancement of Science, an inventor, S. H. Schneider, exhibited a model for producing electricity which, he claims, will revolutionize the electrical world. It is a waterproof and airtight box so constructed that it opens and shuts like an ordinary folding dinner box. When folded it naturally sinks to the bottom of water, but reaching bottom the contrivance opens by means of a magnet and, being lighter than the water it displaces, rises to the surface, where it again folds up and sinks. The inventor states that by the action of this box electrical power can be generated, and claims that a "generator" weighing 600,000 lb. displaces 10,000 cu. ft. of water and will generate 831,998,000 foot-pounds per half minute. As no fuel of any kind is required, Mr. Schneider claims power can be generated at a very low price.

# A South American Gas-Engine-Driven Central Station.

By J. P. Stone.

A VERY successful example of a central station driven by gas engines is in the city of Dolores, Argentine Republic, situated about 125 miles to the south of Buenos Aires, in the Province of the same name. A company was formed in 1907 by the most influential citizens and business men of the city to build an electric generating station to supply the city and surrounding country. They secured the authorization of the Provincial Government by a decree of July 13, 1907, and, having looked into the question of the most suitable power, and studied the operating costs of both gas and steam plants, decided to adopt gas power. The contract was signed on Aug. 19, 1907, with Messrs. Agar, Cross & Company, Limited, of Buenos Aires, for the complete installation of station machinery and the distribution system throughout the city.

Dolores is one of the oldest cities in the Province, and is in the middle of a rich stock-raising district. Here are situated the courts of justice, banks, a fine club-house, and one of the provincial jails.

The street illumination in the city is provided by open-arc lamps, which burn nine in series across 440-volt mains. The lamps require 8 amp, are recarboned daily, are suspended over the center of the streets, and are raised and lowered by windlasses which are placed on the poles. One lamp is placed at each street corner, but in the central streets an extra lamp is placed midway between. In the principal plaza, however, there is in addition to the other arc lamps a special series of eight flame-arc lamps, which are only lighted on special occasions. The arc-lamp circuits are separate from the private lighting feeders, and each circuit of lamps is controlled from the arc-lamp board in the power house, which has a single-pole knife switch and ammeter for each circuit.

The power station shown in Fig. 2 is situated at the corner of two of the principal streets near the distribution center of the cable network. The building is of brick with cement finish in imitation stone and is provided with large windows giving ample light and ventilation. It is divided into sections, having producer room, engine and dynamo room, general manager's office, show and salesroom, storeroom, etc. The engine-room has tiled floor, and the walls are faced with glazed tiles to a height of 6 ft. The producer room has a tiled floor, as well as large windows to give ample ventilation. A large water tank is placed on the roof, and in the yard is a large cement reservoir having a cooling tower built over its entire length.

The generating machinery consists of two units, the smaller of which is a two-crank, tandem, vertical gas engine, with four cylinders, two of 10½ in. and two of 11½ in. diameter by 14-in. stroke. This engine develops 100 bhp, and is direct-connected to a 65-kw, three-wire, 440-220 volt, direct-current generator having a current output of 147 amp. The larger engine is a three-crank, tandem, vertical gas engine and has six cylinders, three 10½ in. and three 11½-in. by 14-in. stroke. This engine develops 150 bhp and is direct-connected to a 95-kw, three-wire, 440-220-volt, direct-current dynamo, having an output of 216 amp. Both these engines run at a speed of 325 revolutions per minute.

The dynamos are of the multipolar engine type, with an outboard bearing, the shaft having a half coupling which is bolted to the engine flywheel. Each machine supplies the three-wire circuits direct, without any rotary-balancer sets, and is of the

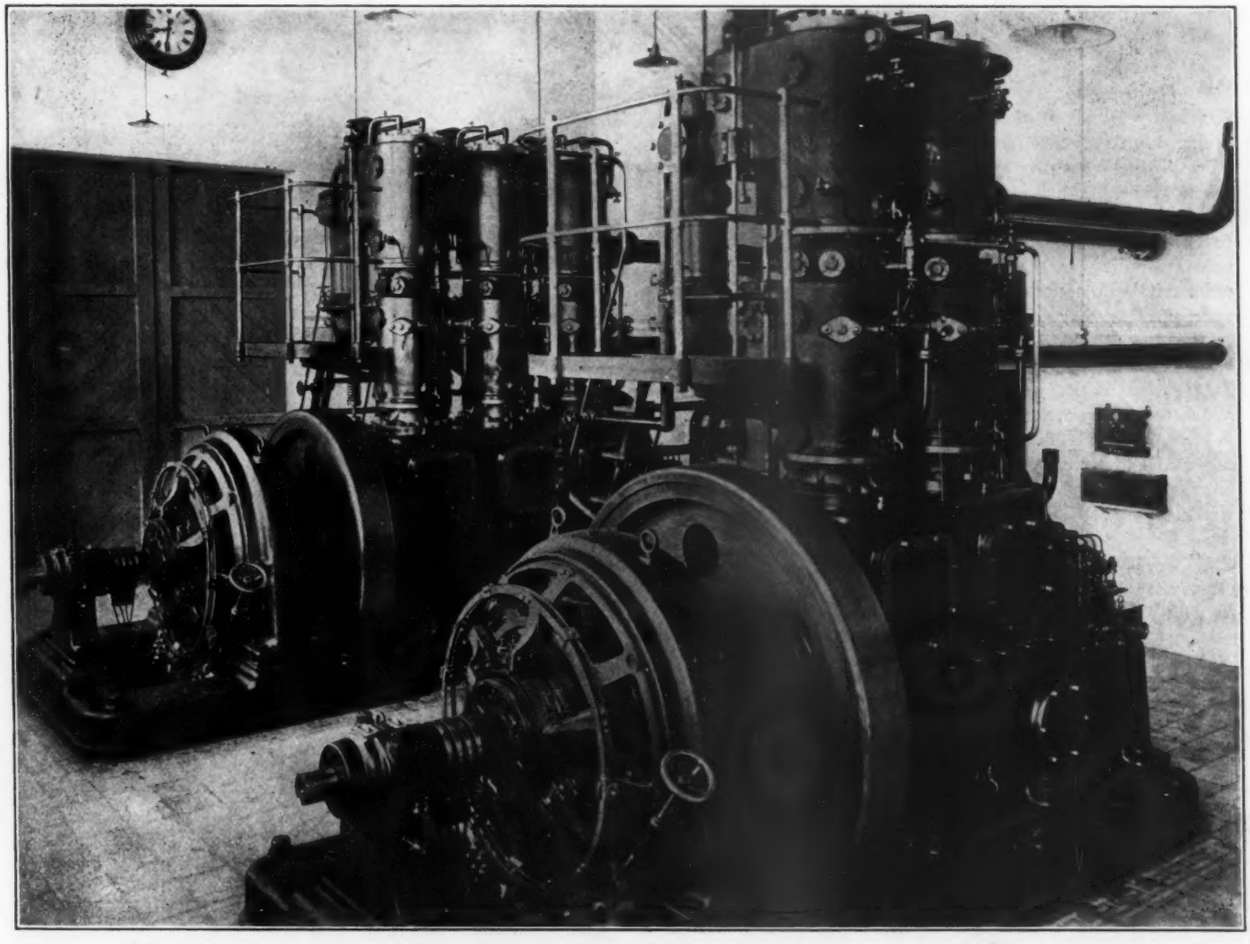


FIG. 1.—INTERIOR OF GENERATING STATION AT DOLORES.

usual six-pole construction with cast-iron yokes and laminated pole-pieces, the yoke being parted horizontally. Each pole carries two distinct sets of series windings, one of which is connected in each of the main leads, to enable the machine to take care of unbalanced loads, which they are capable of supplying up to 25 per cent without disturbing the regulation. The third or neutral wire is formed from four taps which are taken from the armature at equidistant points, and brought out to four collector rings, the leads from which are connected to two balancing coils or transformers, the center points of whose windings are connected, and which form the neutral point of the generator, from which the connection is taken to the neutral busbar on the switchboard.

FIG. 2.—POWER HOUSE, DOLORES.

The gas engines shown in Fig. 1 are the British Westinghouse Company's vertical tandem type, and were built at its Manchester works. The cylinders are arranged in pairs one above the other, and the water jackets and valve chambers are in one casting, a cast-iron intermediate cover separating the upper and lower cylinders, this being held in place by eccentric bolts, the joint being made by a copper ring. Both heads are water jacketed. The two pistons act on one crank, and as the pressure is always downward on the connecting rod, there is much less wear on the bearings and they are therefore made non-adjustable. The moving parts are enclosed in the crankcase, which acts as an oil chamber in its lower part. All the bearings are oiled by forced lubrication at a pressure of 30 lb. per square inch by means of oil pumps actuated by anchored eccentrics on the main shaft, the oil being filtered before reaching the pumps. The filters are in duplicate and either can be removed for cleaning without interfering with the operation of the pumps. The upper cylinders and piston rod glands are lubricated by a special pump having sight feeds and a flushing arrangement, but the lower cylinders are oiled by restricted splash.

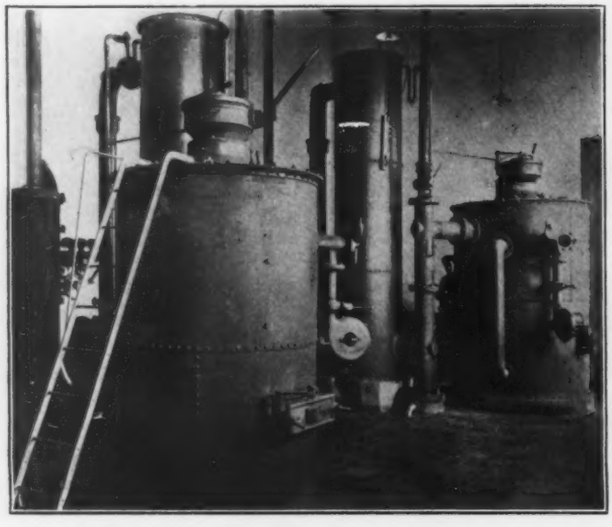


FIG. 3.—VIEW OF GAS-PRODUCER ROOM.

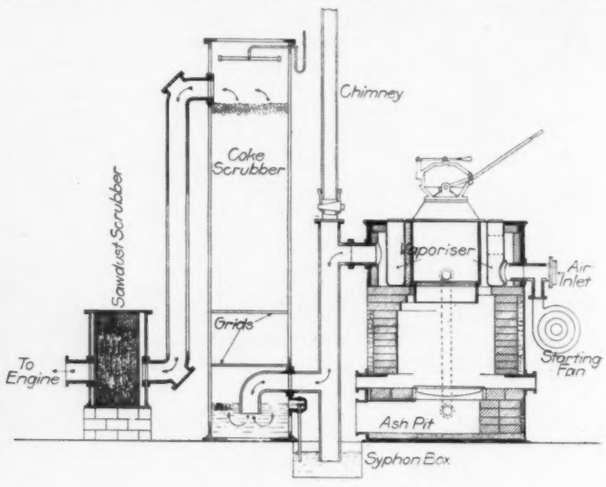



FIG. 4.—SUCTION GAS-PRODUCER PLANT.

The ignition system used is high tension with trembler coils, a commutator on half-speed shaft controlling the low-tension circuits. A movable yoke carrying the brush holder permits of retarding or advancing the spark, the energy being supplied by a small dynamo, and storage batteries at 6 volts. The governor of these engines is mounted directly on the end of main shaft, and is connected to the throttle valve by a bell crank lever, without the intervention of any gearing, as was formerly employed, and so controls the volume of air and gas admitted to the cylinder. The air and gas are kept separate until they reach the inlet valves, which minimizes the danger of explosions in the manifolds. The inlet and exhaust valves are of the mushroom type, the inlet valves being of steel with chamfered seats, and the exhaust valves of cast-iron with flat seats, neither being water-cooled.

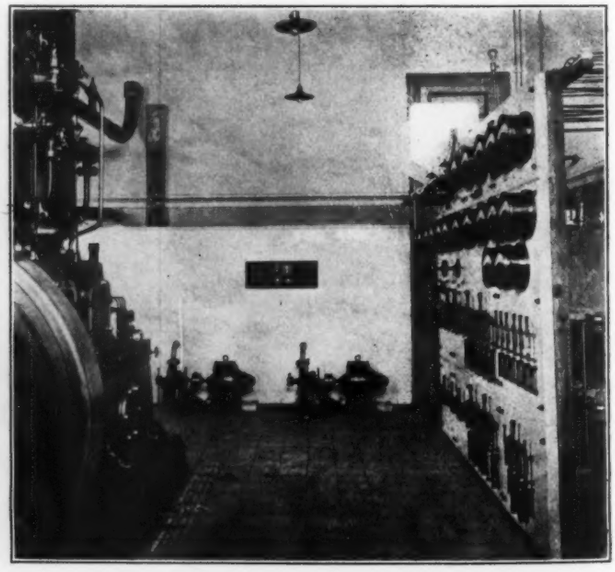


FIG. 5.—SWITCHBOARD AND MOTOR-DRIVEN CIRCULATING PUMPS.

The starting of the engines is accomplished by admitting compressed air under 300-lb. pressure to the lower cylinders, this air entering through non-return valves and so starting the

engine under full compression. The admission of air to the starting cylinders is controlled by tappets operated by cams on a secondary shaft, which are normally held out of action by springs, but when the compressed air starting valve is opened these are thrown into action by the air pressure and admit air to the cylinders at the right moment to produce the starting impulse. As soon as the gas explodes in these cylinders, the air supply is automatically cut off. The attendant only has to open the compressed air valve to start the engine, and after one or two revolutions shut the valve, there being no cams or other gear to manipulate. The exhaust manifolds are water jacketed, but no water is used in the exhaust pipe. The exhaust pipes pass through the dividing wall into the gas-room where the silencers are situated, and from there the escape pipes pass up through the roof.

The gas plant, shown in Figs. 3 and 4, consists of two Dowson suction producers, one of 100 bhp and one of 150 bhp, together with their coke and sawdust scrubbers and purifiers. The coke towers have a water spray at the top to wash impurities out of the hot gases as they are delivered from the producers, after which they are filtered through damp sawdust. Each producer is piped direct to its engine, and a cross connection provided between the two pipes for emergencies. Anthracite coal, which costs $12 per ton, is used in the producers.

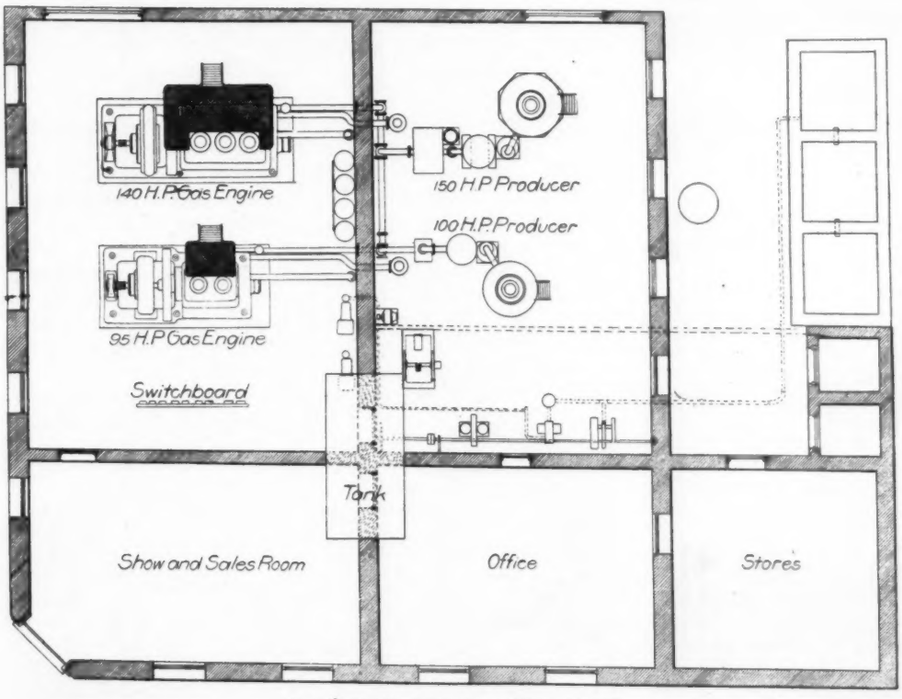



FIG. 6.—PLAN VIEW OF POWER HOUSE.

The switchboard, shown in Fig. 5, is of white marble and built of four panels, two being for the dynamo, one for the lamp and motor feeders, and the other for the arc-lamp circuits. All circuits have switches, enclosed fuses and ammeters, the instruments having black marine finish. The dynamo panels have automatic circuit-breakers which are provided with both main and equalizer contacts. The busbars are carried on cast-iron brackets bolted to the angle iron supports, these same brackets being provided with porcelain insulation and clamping blocks. There are four three-wire feeders leaving the switchboard for the private lighting, and eight arc-lamp circuits. Overhead construction is used throughout, the wires and cables being carried on deep groove-glass insulators with steel pins. The poles are of hard pine with hardwood feet bolted on, and hardwood cross-arms. All wires and cables have double-braided, weatherproof insulation, and the whole cable network is amply protected by Westinghouse-type lightning arresters, the neutral conductor being earthed.

Cooling water for the engines is taken from the tank on the roof of the building, from which it flows by gravity through the jackets and empties into a large cistern in the yard. The latter reservoir is divided into three compartments, and has a cooling tower construction over the whole of its length. The hot water from the engines empties into one of the end compartments, and from here a triplex pump elevates it to the top of the cooling tower, which is filled with brushwood, through which it slowly trickles into the middle compartment, which has an outlet communicating with the other end section into which the cold water flows. The centrifugal circulating pumps (shown in Fig. 5) take it from here and deliver it into the tank on the roof of the building. Thus the water is used continuously; only that lost by evaporation or used for gas washing has to be made up. An artesian well and pump are provided for this purpose, the piping being so arranged that the cold well water can be forced either into the yard reservoir or the overhead tank.

The pump and air compressor are placed in the gas-room, and are belted to a line shaft, which can be driven either by an electric motor or a naphtha engine. The general arrangement of machinery is shown in Fig. 6. The roof tank provides a sufficient supply of water to start up the gas plant, and insures a supply of water for the engines for some time, in case of failure of one of the centrifugal circulating pumps, and would enable the plant to keep running until the pump could be put right.

This station went into service in August, 1908, operating from dusk to 6 a. m., as the only load was that of the 72 street arc lamps, necessitating the operation of only the small engine. The company, as soon as it began operations, was overwhelmed with calls to give private connections, and it had to put on a staff of men for this purpose, which resulted in such a rapidly increasing load that within a month the large engine had to be run regularly to carry the peak load. A diagram of the station load, taken only two weeks after the plant started, is shown in Fig. 7. The load has steadily risen until now both engines are run to carry the maximum demand, and after that the large engine is run alone.

All energy for lamps and motors to private customers is supplied by meters (Westinghouse watt-hour meters being used throughout). Up to 5 amp, the installations are two-wire, 220 volts, and above that three-wire, 220-440-volt mains are used.

The energy rate for lamps is 17 cents up to 50 kw-hours and for energy in excess of 50 kw-hours 15 cents per kw-hour. The rate for motors up to a consumption of 200 kw-hours is 13 cents. Energy in excess of 200 and up to 500 kw-hours is charged at the rate of 11 cents, and above 500 kw-hours the rate is 8.5 cents. Electricity is supplied to the provincial jail at a flat rate of $252 per month, the installation consisting of 200 incandescent lamps, and six 5-amp, enclosed arc lamps. For each street arc lamp the charge is $11.85 per lamp per month for 72 lamps and $10.50 per lamp per month after the additional 36 lamps are added. For the series of eight flame-arc lamps, which are lighted on special occasions, averaging five times per month, the rate is $3.50 a night. The company does not do installation work, but keeps a showroom in the

station where the latest appliances and fixtures can be seen, among which is the tungsten lamp. Since Dec. 1, 1908, a day service has been maintained to enable electric fans to be used, and the company has been rapidly building up a day load. Since day service has been inaugurated electric motors have been installed in a number of places, and several factories having steam plants are arranging to put in motors and discontinue the use of their steam power. There is also a company being formed to build a flour mill, which will take electricity for lamps and motors from the central station.

A comparison of the load curves for Sept. 1 and 29, illustrated in Fig. 7, shows the increase of load in one month clearly and the load curve. A curve taken a few months later, shows an increased output of this station during the short time it has been in operation; the peak at 8:30 p. m. reaching 246 amp. Public street lighting is being extended, and 36 more arc lamps added, which brings the peak load up to 350 amp.

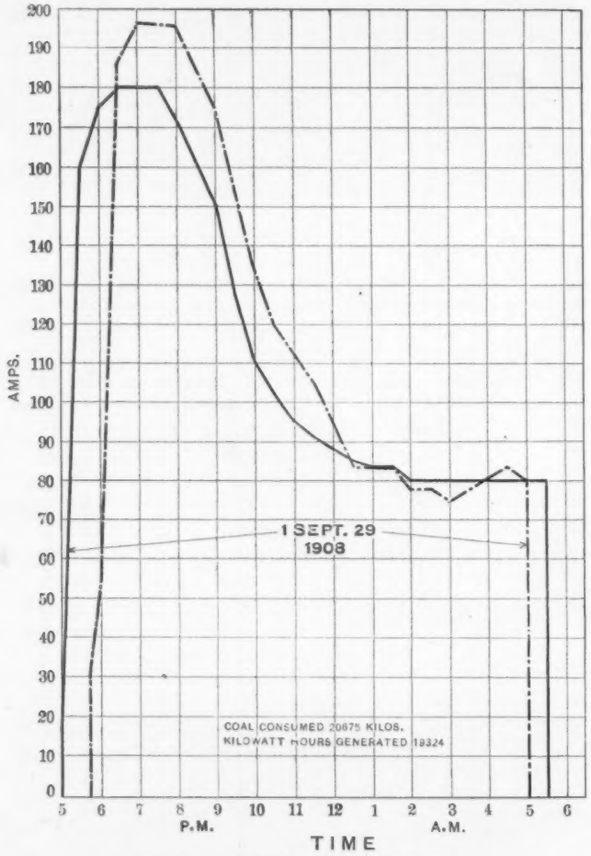



FIG. 7.—COMPARATIVE LOAD CURVES.

As the station equipment is now loaded up to its full rating, very few new installations can be taken on. However, to enable the company to provide an adequate service to cope with all the increasing requests for electricity, it was decided to enlarge the station and install a 240-hp gas engine, direct-connected to a 150-kw, three-wire, 440-volt dynamo, with a suction gas producer of corresponding rating. To keep a homogeneous power-house equipment, this new set, together with its switchboard, will be of the British Westinghouse Company's make, and the gas-producer plant will be supplied by the Dowson Company. When this new unit is put in, the output of the station will be doubled, and the company will be in a position to extend its lines and cope with the rapidly increasing demands. The plant is operated by three men to a shift, and they are the ordinary type of mechanic and laborer found in the country. The station is one of the most successful and economical in the Argentine Republic, and is giving the greatest satisfaction. The coal consumption is one-third of what it would have been if a steam plant had been adopted.

## Hydro-Electric Development of the Connecticut River Power Company.

WHILE there are several hydro-electric transmission plants in New England, these have been developed by public-utility companies for their own purposes and the transmissions are restricted to their respective territories and are more or less limited in scope. The first hydro-electric plant in New England with a transmission line that serves a market represented by a number of prosperous towns and cities to which electrical energy is sold in bulk is that of the Connecticut River Power Company. The site selected for the generating station is desirable because the natural conditions are most favorable to the hydraulic development, and the wisdom of this selection is further borne out by the fact that before the station was placed in operation, and practically without much solicitation, enough energy had been contracted for to cover fixed charges and operating expenses.

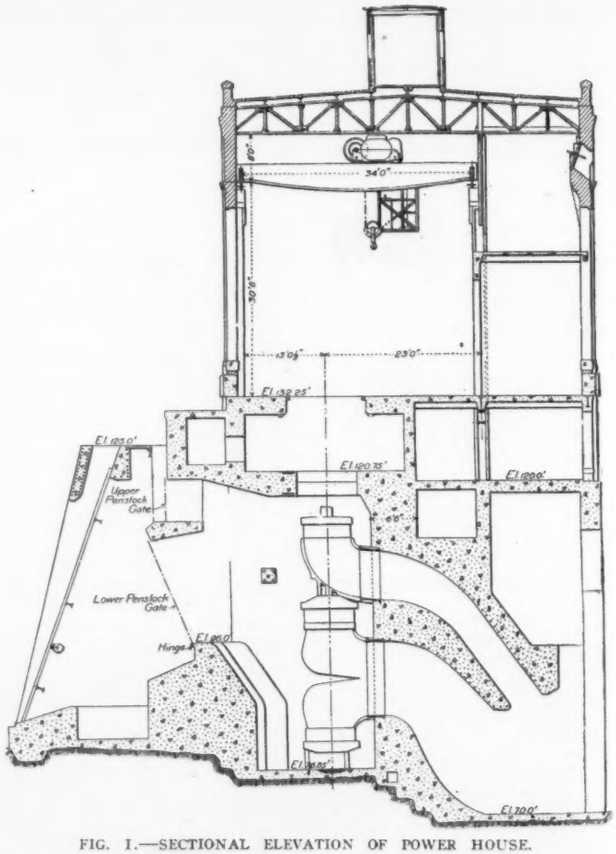



FIG. 1.—SECTIONAL ELEVATION OF POWER HOUSE.

The generating station and dam are located on the Connecticut River between Vernon, Vt., and Hinsdale, N. H., and five miles from the Massachusetts State line. The river at this point is supplied by a drainage area of 6300 square miles, having an average rainfall of approximately 36½ in. The length of the dam at the crest is 600 ft., and the maximum head available is 34 ft. The average head is 32 ft., and the pond area back of the dam, 1900 acres. The power house is designed for an ultimate output of 20,000 kw, but the present installation is only 12,500 kw. The water available and the reciprocal provisions in contracts made permit the use of customers' steam plants as auxiliaries, so that the company will be enabled to deliver for an average year 67,000,000 hp-hours in primary power and 33,000,000 hp-hours in secondary power, or a total of 100,000,000 hp-hours. The transmission lines are 66 miles long.

The market which the company serves lies within a radius of 60 miles of the generating station and comprises one of the richest manufacturing districts in New England. The lines at

present reach the following centers: Brattleboro, Vt., Keene, Winchester, Hinsdale, N. H.; Winchendon, Gardner, Fitchburg, Shirley, Leominster, Clinton, Marlboro and Worcester, Mass. The aggregate population of the towns and cities enumerated is 271,000. The industries in them are widely diversified, there being not less than 3000 different classes of product, and in many instances the factories located in the district are the largest of their kind in the United States. In addition to the industrial demand for electrical energy, there are within the area served 10 lighting and five street-railway companies, with some of which contracts have already been made. With such a large market for energy, it is but natural that the cost of steam power, which is brought in competiton with the water-power, should be an important factor. The prevailing price of coal in the region is $4.50 per ton and at this price it is an easy matter for the company to compete with steam-driven stations already in existence.

FIG. 2.—EXTERIOR VIEW OF GENERATING STATION AND DAM ACROSS CONNECTICUT RIVER.

The masonry structures composing the development at Vernon have a length of 846 ft., extending from the Vermont to the New Hampshire shore. Of this 600 ft. are taken up by a plain concrete spillway; 13 ft. by a log sluice, and the remainder by the power house, which is 51 ft. x 219 ft. inside dimensions. The power-house substructure is built of reinforced concrete and the superstructure of steel and brick. The earth embankments on either side rise 20 ft. above the spillway crest and are retained by abutments. The latter are parallel with and at a small angle to the flow of the river, and the dam at one end and the power house at the opposite end are built against them. Not only do the abutments and wing walls retain the bank and protect them from erosion, but they also serve as cut-off walls, extending and being bonded to rock foundation. The width at the top of the abutments and wing walls is 3 ft. The east abutment is 445 ft., and heavy rip-rap protects both sides.

The portion of the dam across the river channel is 50 ft. above the rock on which it rests, and a portion 250 ft. in length is not more than one-quarter of this height. About 150 ft. east of the center of the length of the dam the height from foundation to crest is 70 ft. The crest of the dam is at elevation 118 about 30 ft. above normal low water, and flash boards are used to raise the level of the pond to secure a working head of 33 ft. to 34 ft. The down-stream face of the dam is ogee shaped. The normal section, except through the portion containing the sluice gates, differs from the section shown herewith only in having a straight vertical face in the plane indicated as "line of dam" in the drawing. In order to pass moderate floods, 10 permanent sluice gates, each 7 ft. x 9 ft., are built in the section of the dam across the main channel, and are separated from the power house by a log sluice and a portion of the normal dam section 54 ft. long. The gates are opened by hand-wheel stands in a chamber built within the dam. Manganese bronze rising stems pass above the roof of the chamber into a 6-in. circular-steel lining built into the dam, and terminating a few inches beneath its crest. Access to the operating chamber is had through a 4-ft. x 6¼-ft. passageway 54 ft. long built into a section of the dam between the sluice gates and the log sluice, where the entrance is located.

The sluiceways are placed on 18-ft. centers and have 8-ft. walls of concrete between them. Extending up-stream from the normal face of the dam between adjacent sluice-gate openings are monolithic concrete piers rising to within 2 ft. of the crest, which afford space for stop-log grooves and gratings for catching trash. The piers decrease in thickness from 9 ft. to 4 ft., and have a flaring approach to the sluiceways, with a maximum width of 14 ft. The trash racks are made up of 2-in. round-iron rods, spaced 15 in. on centers vertically, and

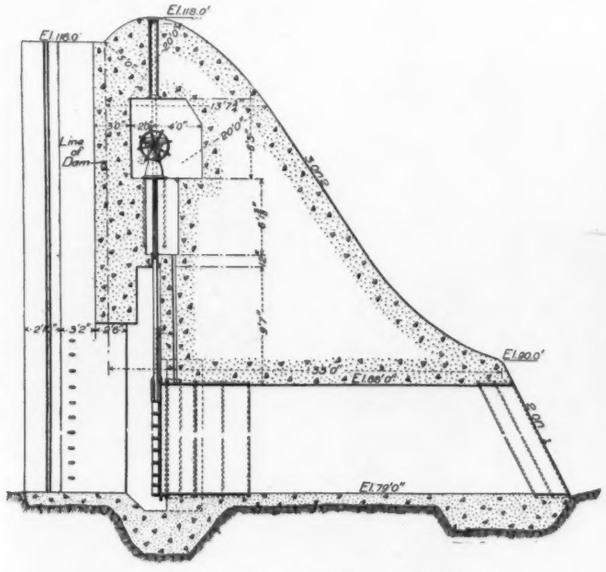



FIG. 3.—SECTIONAL ELEVATION OF DAM.

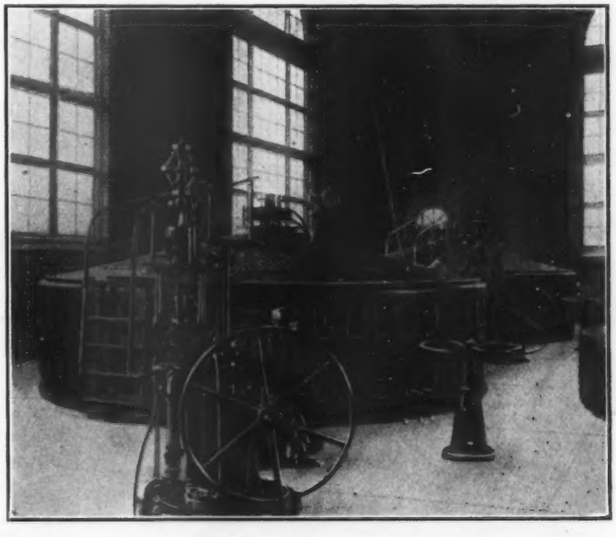


FIG. 4.—CORNER OF GENERATOR ROOM.

anchored to similar rods imbedded in the concrete. The stop-logs are dropped from the pond level into the grooves provided for them when it is desired to make repairs to the sluice gates. The discharge ends of the sluice-ways have cast-iron linings for a length of 3 ft. The log sluice is separated from the main body of the dam by a 4-ft. wall. It is fitted with a timber bear-trap dam, the crest of which can be raised 9 ft. In ordinary operation, logs, trash and floating ice will be diverted to it by means of floating booms running diagonally in front of the power house on the shore. The booms consist of heavy built-up floating logs, held in grooves on the faces of reinforced concrete piers spaced about 70 ft. The total length of the booms is about 350 ft. The four piers used to hold the booms are 8 ft. wide and 10 ft. long on top, and about 40 ft. high from the rock foundation.

FIG. 5.—VIEW OF MAIN SWITCHBOARD.

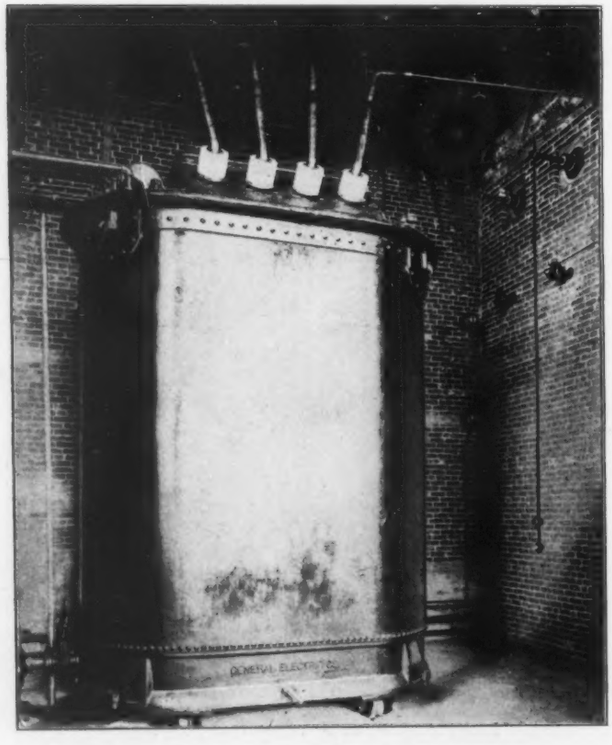


FIG. 6.—5000-KW STEP-UP TRANSFORMER.

The generating station is on the Vermont side of the dam, and houses in the reinforced-concrete substructure the turbines, penstocks and draft tubes, and in the superstructure the main electrical units, exciters, transformers and switches. The superstructure is provided with two longitudinal bays; one 35 ft. wide being occupied by the generators, exciters and switchboard, and the other, 15 ft. wide, containing two stories, housing the transformers and auxiliary electrical equipment. The generator-room is designed for 10 units; eight main units, five of which are installed, rated at 2500 kw, three-phase, 60-cycle, 2300 volts and 133 r.p.m., and two exciters rated at 300 kw at a speed of 190 r.p.m.

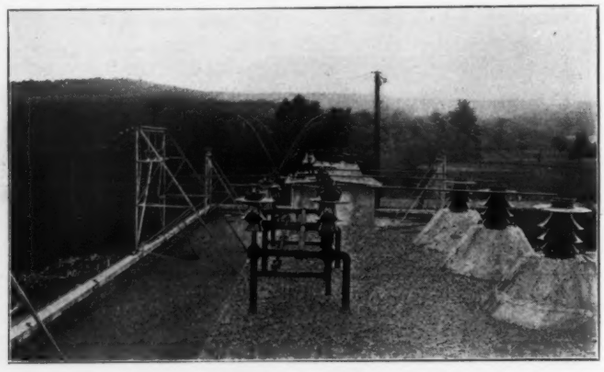


FIG. 7.—OUTGOING LINES ON ROOF.

All the units are placed parallel to the length of the power house on 24-ft. centers, and are of the vertical-shaft type. The waterwheels were built by the S. Morgan Smith Company, of York, Pa., and are regulated by Lombard governors. The entire electrical equipment was built by the General Electric Company.

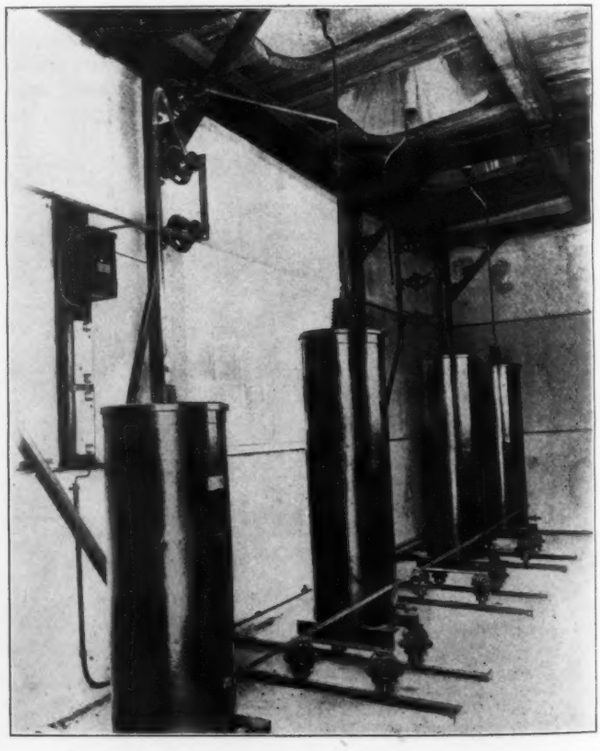


FIG. 8.—ALUMINUM CELL LIGHTNING ARRESTERS.

The penstock for each main turbine unit is 20 ft. 9 in. wide, and is separated from the adjacent penstock by a 3 ft. 3 in. vertical reinforced-concrete wall, which extends up-stream from the power-house structure to form a support for the racks. Each penstock enlarges in height to 40½ ft. to form the wheel

chamber, in which are three wheels on the same vertical shaft. Each large generator is direct-connected to two 60-in. and one 57-in. wheel. The draft tubes are in two parts, the top wheel discharging into the upper one, and the other two wheels into the lower one. The upper draft tube is 7 ft. 8 in. in diameter at its beginning in the down-stream wall of the wheel chamber

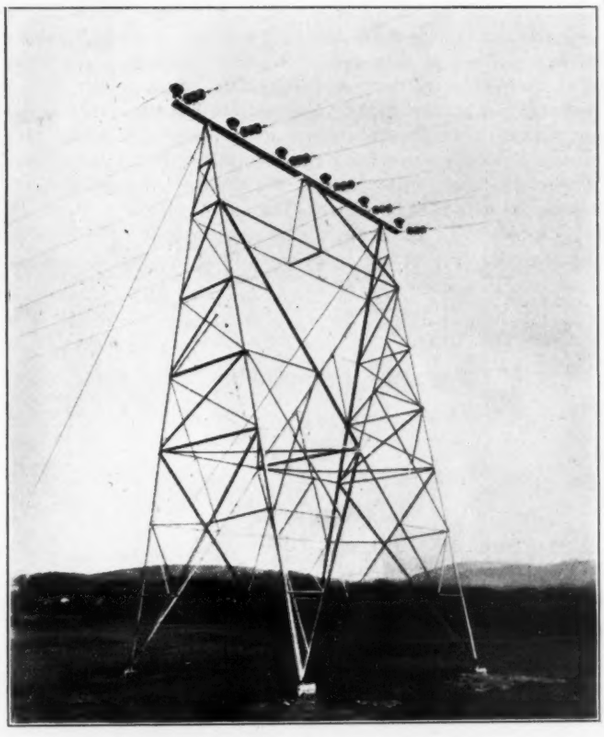


FIG. 9.—ANCHOR TOWER ON NEW HAMPSHIRE SHORE AT END OF 1375-FT. SPAN ACROSS RIVER.

and changes gradually to a rectangular section 4 ft. 9 in. high and 19 ft. long, this change being made in a length of 14½ ft. The final section then continues for over 13 ft. to a point where the upper and lower draft tubes join into one, and discharge into the tail-race about 8 ft. above the down-stream wall of the power house. The lower draft tube is 11 ft. high and 11½ ft. wide at the down-stream wall of the wheel chamber, and increases in size to about 15½ ft. in height and 19 ft. in width. The draft tubes discharge to the tail-race through arches carrying the down-stream wall of the power house. The exciter penstocks have a width of 8 ft. 10½ in., and each exciter discharges separately into a single flaring riveted-steel draft tube.

In order to be able to drain each wheel chamber to inspect and repair the turbines, penstock gates are provided back of the racks on the up-stream side of the power house, and stop-log grooves are provided just within the arches supporting the down-stream wall. Each turbine being in a separate wheel chamber, any one of them can be shut down without interfering with the operation of the others. Each large penstock is divided into two unequal parts by a heavy horizontal reinforced-concrete girder that enables the penstock to be shut by two separate gates, one above and the other below the girder. The lower opening has a height of 15 ft. and is closed by a steel gate 20 ft. 5½ in. wide over all and 17 ft. 5 in. high. The upper opening is 6¾ ft. high and is divided longitudinally by a 3-ft. vertical pier into two 8 ft. 10½ in. widths, each of which is closed by a timber gate 9 ft. 7¼ in. wide and 6½ ft. high. The dividing pier rests upon the heavy reinforced-concrete girder and extends to the level of the penstock. The lower gates are made with 12-in., 40-lb. I-beams in vertical planes 11½ in. apart, and are riveted at the top by means of two angles each to an I-beam of the same size, and at the bottom to a 12-in., 40-lb. channel. The front is covered by a ⅜-in. plate riveted to the I-beams and the back is left open. The upper gates are made of dressed pine.

The lower gate is hinged on its lower end, and when raised to close the penstock slopes up-stream, the upper end taking bearings on the heavy girder already referred to. When lowered to allow flow through the penstock the gate falls outward and rests upon the floor of the forebay. Water-tightness is secured at the walls by means of oak strips against which the gates bear. The gates are raised and lowered by means of a chain passing through a 6-in. pipe placed on the center line of the penstock and running up into the main generator-room, where it is attached to the traveling crane with which the station is equipped. The upper gates are raised and lowered in a vertical plane, the hoists for this purpose being located on a runway along the upstream wall of the power house and immediately back of a similar walkway from which the racks may be cleaned and hauled out for repairs.

The cross-sectional elevation of the power house, Fig. 1, shows the arrangement of floors. The main floor carries the generator, transformers and governors, and the lower floor carries the thrust bearings and governor pumps, the piping and oil tanks for both, and on the down-stream side of the dividing wall the low-tension busbars and switches. The thrust bearing is located in the lower chamber between the wheel and the generator. The initial transforming equipment consists of three 5000-kw oil and water-cooled, three-phase transformers which step-up the potential to 66,000 volts, and a 900-kw transformer for feeding a few customers in Vermont. The lines emerge from the roof of the station and cross the Connecticut River to the New Hampshire shore, the span being 1375 ft. The transmission line is made up of No. 2 seven strand, hard-drawn copper with soft copper core and is protected at the station end and at the substations by aluminum cell lightning arresters. The line is equipped with telephone service and a ground wire is carried along the tops of the towers. The 66 miles of line to Worcester consist of two separate circuits, either one of which in an emergency can carry the entire load. The transmission system has been erected with a view to giving continuous service during the extreme conditions of winter weather in New

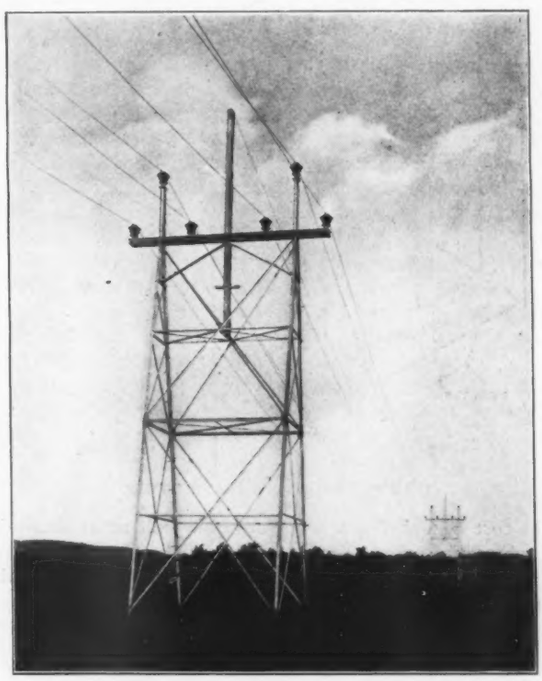


FIG. 10.—VIEW ALONG TRANSMISSION LINE.

England. There will be five substations erected, four of which are already in operation. Other details of the equipment and a description of the transmission system will be given in a later issue.

# The Design of Shell-Type Transformers.

By Roger P. Heller.

WITH the commercial introduction of the new alloy steels there has come about a radical modification in the construction of transformers. The following procedure for the rapid determination of the dimensions of transformers may, therefore, be of some immediate use.

The designer is presented with a series of specifications which he is called upon to realize as closely as possible in the finished apparatus. As is well known, different designers will produce apparatus which may differ to an extreme in general proportions, and yet be remarkably similar in performance. This result is, of course, due to the large number of variables, which offer a great number of like solutions, from which it is the duty of the designer to pick the most economical. While the method here outlined leaves much latitude for such choice, it will greatly hasten the work of comparing the results of the separate arbitrary assignments.

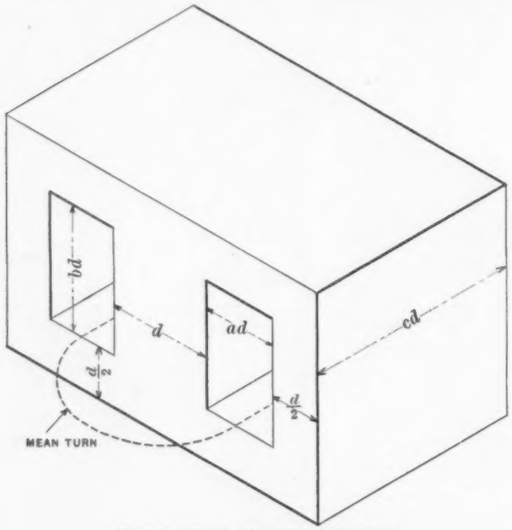
We assume that the specifications imposed are: Primary voltage, $E_1$; secondary voltage, $E_2$; frequency, $f$; secondary watts output, $W_2$, and full-load efficiency, $e$. From these can be computed the primary and secondary currents and the total losses. The latter may be divided between the copper and iron at the discretion of the designer, according to the average load of the transformer, in order to procure a satisfactory all-day efficiency, although it is now being recognized that this is not as important a matter as was formerly considered.

The fundamental equation of the transformer is here shown. It gives the relation between the counter-e.m.f. induced, by the alternating flux, in the primary winding (substantially equal to the applied primary e.m.f.) and that flux.

$$E_1 = 4.44 \times B \times A \times f \times N_1 \times 10^{-8},$$

where

$B$ = maximum flux-density in the iron.
$A$ = area of cross-section of iron, normal to flux.
$N_1$ = Number of turns in series, primary winding.




CORE OF SHELL-TYPE TRANSFORMER.

The core of a shell-type transformer is built up as shown below where the several dimensions are indicated. Neglecting any subsequent trimming of corners, it may be shown that the gross volume of the core is

$$2 \times c\,d^3\,(a+b+1),$$

and if 10 per cent be allowed for japanning, etc., between laminations, the net volume of iron is

$$V = 1.8 \times c\,d^3\,(a+b+1).$$

The cross-section of iron offered to the flux in the middle tongue of the core is

$$0.9 \times c\,d^2 = A,$$

and the rest of the magnetic circuit is so proportioned as to offer the same area to the flux.

The area of the "window" through which the primary and secondary coils are to link is $a\,b\,d^2$, and of this area a certain fraction is occupied by copper. This gross "space-factor" $s$ is rather low, as there must be plenty of room for the necessary insulation and passages between the coils for oil or air. It may vary from 0.3 to 0.4, and the designer must choose a value consistent with the degree of insulation and cooling desired.

Knowing the primary and secondary currents—the magnetizing current in the primary being ignored for these preliminary determinations—one can readily find the cross-sectional areas of the wires for primary and secondary windings which will give a proper current density $k$, say, from 850 amp to 1000 amp per square inch, in the copper at full load. The designer chooses a suitable value for $k$ and then selects that standard size of wire which will most nearly fulfill the desired condition, unless special wire is to be drawn. The amp-turns of the two coils being substantially the same, the areas occupied by the primary and secondary copper are equal for a given current density, or

$$N_1 \frac{I_1}{k} = N_2 \frac{I_2}{k}$$

One may then write,

$$2 N_2 \frac{I_2}{k} = s\,a\,b\,d^2$$

Or.

$$I_2 = \frac{k\,s\,a\,b\,d^2}{2 N_2}$$

And also,

$$E_2 = 4.44 \times B \times A \times f \times N_2 \times 10^{-8} =$$
$$4.44 \times B \times (0.9 \times c\,d^2) \times f \times N_2 \times 10^{-8}.$$

The rating of the transformer is then, in volt-amperes,

$$E_2 I_2 = 2.22 \times 0.9 \times B \times f \times 10^{-8} \times k\,s \times a\,b\,c\,d^4.$$

In such preliminary work, in which the main object is to fix the main dimensions, it is entirely admissible to ignore such details as the effect of the magnetizing current upon the total primary current, or the differences between the counter-generated and the terminal voltages, for at the most these amount to only a few per cent. The procedure of design will be as follows: Suitable values are set down for $s$ and $k$, not much latitude being offered in this direction. From curves showing the watts lost in the particular grade of iron per pound or per cubic inch at the specified frequency, plotted in terms of flux-density, there is chosen such a density as will give a reasonably low value of core loss. It must be borne in mind that with the new alloy steels the density can be run up nearly to the knee of the saturation curve, with a low core loss, but such practice tends to make the transformer take an abnormal rush of current under abnormal voltage-conditions. It will now be possible to express numerically the value of $a\,b\,c\,d^4$ by substituting in the last equation. This numerical value is then represented thus,

$$P = a\,b\,c\,d^4.$$

It is desired to build up a set of equations which will render the determination of the dimensions possible. To do this it is necessary to assume a definite number of turns for the windings. This is done with due regard to the separation of each winding into a number of coils, which may be put in series or parallel according to the voltages of primary and secondary mains. It is desirable to take several values for $N_2$ in order that the several separate calculations may be compared. This does not involve much extra labor, as the specifications are fixed, the space factor and current density are fairly definite, and there are definite limits to the flux density, so that the number of turns is the only variable which may be altered between widely differing values.

From the total core loss previously decided upon, the volume of the iron core is determined and one can set down a numeric

$$\frac{V}{1.8} = Q = c\,d^3\,(a+b+1).$$

From the assumed number of turns the area of the window is set down as,

$$a\,b\,d^2 = \frac{2 N_2 I_2}{s\,k} = w$$

From the total copper loss previously decided upon, the currents in the primary and secondary and the sections of wire chosen, the mean length of a turn is determined. This is set down as $m$, expressed in the same units as the other dimensions. The relation between $m$ and these dimensions is

$$m = 2cd + \pi(d + ad) = d(2c + 3 + 3a).$$

This assumes the end bends to be semicircular and the factor $\pi$ is set down approximately as 3.

There are now four equations from which can be determined the four unknown quantities. They are very inconvenient to solve, but by a tedious process of reduction the writer has arrived at the following cubic equation, in which $d$ alone is involved, the coefficients of $d$ being expressed in terms of the quantities previously assumed so that they reduce to numerics. The equation is:

$$3w^2(Pm - 3Qw)d^3 + w(3Qw^2m - 9w^2P - m^2wP - 6P^2)d^2 + 2w(2P^2m - 3QwP)d - 4P^3 = 0.$$

Having solved for $d$, the remaining dimensions follow:

$$cd = \frac{P}{wd}$$

$$ad = \frac{m - 2cd - 3d}{d}$$

$$bd = \frac{w}{ad}$$

A rough drawing may now be made, and it may then be seen whether a practical set of conditions has been assumed. It may be that the assumed number of turns would require an unduly long core, with a great number of stampings, or that the window would be out of proportion, so that great magnetic leakage will result, or that the stampings are of unduly large dimensions. By working out the problem for several values of $N_2$ the best construction is soon ascertained, for there cannot be very much choice in the other variables at the control of the designer. The several sets of results should be carefully compared for leakage reactance, radiating surface, no-load current and cost before any are cast aside and the final drawing is commenced. At high power factors the regulation is mostly dependent upon the resistances of the windings, so that this will have been taken into account in deciding upon the permissible copper losses. At lower power factors the effect of leakage reactance becomes more marked, so that it may become a determining feature.

It is hoped that this method of attack may be of some assistance to those who are called upon to take advantage of the properties of the newer magnetic materials. It is to be kept in mind that, while the above equations are applicable to any system of units, whatever system is chosen must be followed implicitly.

## Relations Between Output, Losses, Dimensions, Weight and Cost of Transformers.

By E. G. Reed.

A TRANSFORMER consists essentially of a winding composed of a number of turns of copper wire, interlinked with a core made up of sheet iron. The copper wire forms circuits for the alternating current and the iron core a path for an alternating magnetic flux. The current-carrying element is divided into two parts; one receiving energy from the supply circuit called the primary winding and the other delivering current to the load, called the secondary winding. The iron core is magnetized by a current taken from the supply circuit through the primary winding. When the secondary is loaded, the magnetizing effect on the core of the secondary load current is balanced by an additional primary current drawn from the supply circuit.

*Iron and Copper Losses.*

The resistance to the electric current offered by the copper wire in the windings of a transformer is the cause of an energy loss called the copper loss. The repeated magnetization and demagnetization of the iron core is the cause of a loss called the iron or core loss.

For the purpose of computation, the copper loss may be thought of as being the product of the loss per pound of copper and the total weight of copper in the transformer. The power loss per pound of copper, $p_c$, is dependent on the current density in the wires and may be expressed as follows:

$$p_c \propto \lambda^2 \qquad (1)$$

where $\lambda$ is the current density in the wires, or the current per unit of their sectional area. The symbol $\propto$ indicates that $p_c$ varies as $\lambda^2$ or is proportional to $\lambda^2$.

By definition,

$$p_c = \frac{\text{watts}}{\text{pound}} \propto \frac{i^2 r}{lq}$$

In this expression $i$ is the current in the conductor, $r$ its resistance, $l$ its length, and $q$ its sectional area. Since $r$ is directly proportional to $l$ and inversely proportional to $q$, this relation may be written:

$$p_c \propto \frac{i^2 l}{lq^2} \propto \frac{i^2}{q^2} \propto \lambda^2,$$

since $\lambda$ is by definition the current carried by the conductor per unit of its sectional area.

The iron loss may be considered as being the product of the power loss per pound of core and the total weight of the core. The iron loss per pound of core $p_i$ is dependent on the magnetic flux density, or the induction $B$ in the core and the frequency of $f$ of the alternating flux. Its value may be expressed as follows:

$$p_i \propto fB^n \qquad (2)$$

where $n$ is a constant.

The value of $B$ may be expressed in terms of the area of the iron core, $A_i$, at right angles to the magnetic lines, of the frequency $f$ and voltage $E$ of the supply circuit and of the number of turns $N$ in the primary winding, as follows:

$$B \propto \frac{E}{fNA_i} \qquad (3)$$

This relation is fundamental in the study of the transformer and is based upon the law that the induced electromotive force in each turn is equal to the rate of change of the magnetic flux through its opening when expressed in c.g.s. units.

*Relation Between the Copper and Iron Losses, the Impressed Voltage Being Variable.*

The losses in a transformer may be varied by changing the voltage impressed on its primary winding, the load current changing so that the permissible output remains constant.

The output of a transformer is rated in volt-amperes, or the product of the secondary voltage and the current delivered to the load. Thus, if the voltage delivered by the transformer is decreased, the current must increase if the output is to remain constant.

The induction in the iron core varying with the impressed voltage, increases or decreases the iron loss. When the voltage is low, the current is large and consequently the copper loss is increased and when the voltage is high, the current and the copper loss are low.

For a transformer having a given kva output at a primary voltage of $E$ the current $i$ for this voltage may be expressed thus:

$$i = \frac{kva}{E}$$

or

$$i^2 = \left(\frac{kva}{E}\right)^2$$

Since the copper loss $P_c$ of a transformer is proportional to the square of the current in its windings, its value may be written:

$$P_c \propto \frac{1}{E^2} \qquad (4)$$

The copper loss curve (Fig. 1) shows in a graphical form the relation expressed in equation (4), the impressed voltage and copper loss being given in terms of their normal values, or the values for which the transformer was designed.

Equation (2) shows that at a given frequency the iron loss

per pound of iron and consequently the total iron loss in the transformer is proportional to $B^n$. Therefore, the core loss of the transformer may be expressed thus:

$$P_i \propto B^n$$

Since the induction in the core $B$ is proportional to the voltage $E$ impressed on the transformer, the above relation may be written:

$$P_i \propto E^n \qquad (5)$$

The iron loss curve in Fig. 1 shows the relation expressed by equation (5), between the impressed voltage and the iron loss, for a value of $n = 1.7$.

From the iron and copper loss curves shown in Fig. 1, it is apparent that as the iron loss becomes small, the copper loss increases very rapidly. On the other hand, when the copper loss in turn reaches low values, the iron loss does not increase as rapidly as did the copper loss.

The sum of the iron and copper loss may be plotted as in Fig. 2. From the three curves shown in Fig. 1 it is interesting

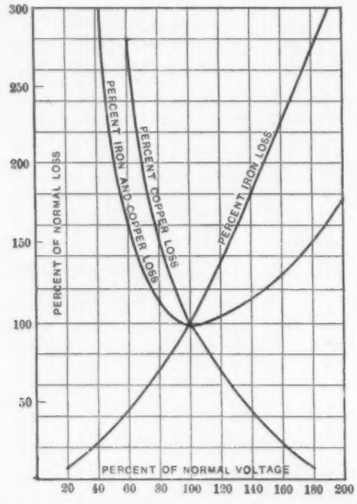



FIG. 1.—VARIATION OF IRON AND COPPER LOSSES AND THEIR SUM WITH IMPRESSED VOLTAGE, THE KVA OUTPUT REMAINING CONSTANT.

to note that as the iron loss increases and the copper loss decreases, the sum of the losses decreases until a minimum is reached, after which it again increases. From an inspection of the curves, it is apparent that the sum of the losses is a minimum somewhere in the region of equality of the iron and copper losses.

Combining equations (4) and (5) there is obtained $P_c P_i^{2/n} =$ constant.

The constant in this equation bears a certain relation to the losses, but is not expressible in watts. Representing this constant by $Q_1$ the relation may be written:

$$Q_1 = P_c P_i^{2/n} \qquad (6)$$

This is an important relation which may be interpreted as follows: A transformer having a core and windings of fixed dimensions, with a constant rating at a definite frequency, has losses such that the product of the copper loss and the iron loss to the $2/n$ power is equal to a constant quantity, the change in the relative values of the iron and copper losses being produced by varying the voltage impressed on the transformer. This results, when the output remains constant, in a varying current in the windings; the core is operated at different flux densities and the copper at various current densities.

The iron and copper losses may be plotted as in Fig. 2, their values satisfying equation (6). This curve is based on a value of $Q_1$ of 1000 and a value of 1.7 for $n$.

Since equation (6) results from the combination of equations (4) and (5), the curve in Fig. 2 expresses the same relation as do the two loss curves in Fig. 1. The curves in Fig. 1, however, represent the general case of any transformer, the iron and copper losses varying with the impressed voltage; the impressed voltage in this case is expressed as a percentage of the normal voltage of the transformer. The curve in Fig. 2 represents the particular case of a transformer having a value of $Q_1 = 1000$, the losses being expressed in watts rather than as a percentage of their normal value.

When a curve similar to that shown in Fig. 2 is available for a certain transformer, it is a simple matter to determine the copper loss associated with any iron loss, or vice versa. It is not an easy task to plot this curve, and when drawn it is applicable to only a particular transformer. A general method of arriving at the same result may be developed as follows:

If $P_i$ and $P_c$ are the normal iron and copper losses respectively of a transformer and $P'_i$ the iron loss associated with a new value $P'_c$ of the copper loss, the relation between these four quantities may be determined from equation (6) as follows:

$$P_c P_i^{2/n} = P'_c P'^{2/n}_i$$

$$P'_i = P_i \left(\frac{P_c}{P'_c}\right)^{n/2}$$

Assuming that $n$ is equal to 1.7, the last equation may be written:

$$P_i' = Pi\left(\frac{P_c}{P'_c}\right)^{.85} \qquad (7)$$

Thus when the normal value $P_i$ and $P_c$ of the normal iron and copper losses in a transformer are known and some new values of either the copper loss $P'_c$ or iron loss $P'_i$ are assumed, it is an easy matter from equation (7) to calculate the value

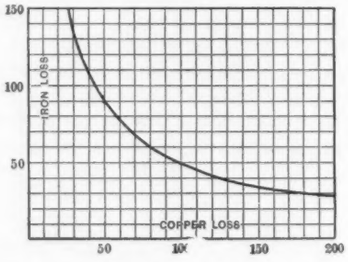



FIG. 2.—RELATIVE VALUES OF THE IRON AND COPPER LOSSES, THE IMPRESSED VOLTAGE CHANGING AND THE KVA OUTPUT REMAINING CONSTANT.

of the unknown iron or copper loss.

Assuming the normal values of the iron and copper losses to be 100 per cent and the new values of the losses to be expressed in per cent of their normal values, equation (7) may be rewritten as follows:

Percentage of normal iron loss = 100

$$\left(\frac{100}{\text{Percentage of normal copper loss}}\right)^{.85}$$

This relation is perfectly general, and to make it more convenient for use, the percentage of normal iron loss resulting from various values of the percentage of normal copper loss may be plotted as in Fig. 3.

*Relation of the Losses for Their Sum to be a Minimum.*

It has been shown that the sum of the losses is a minimum when they are approximately equal to each other. Their exact relation for the sum to be a minimum may be determined as follows:

The total loss $P$ is equal to the sum of the iron and copper losses, or

$$P = P_i + P_c \qquad (8)$$

Substituting in this equation the value of $Pc$ from equation (6),

$$P = P_i + \frac{Q_1}{P_i^{2/n}}$$

Placing the differential of the above equation equal to zero and substituting the value of $Q_1$ from equation (6),

$$\frac{P_i}{P_c} = \frac{2}{n} \qquad (9)$$

If $n$ has, for example, a value of 1.7, the sum of the losses

will be a minimum when the iron loss is approximately 15 per cent greater than the copper loss. This is a perfectly general relation and for a transformer of any rating, voltage or frequency, of any type of design, if the losses bear this relation, their sum will be a minimum.

*Relation Between the Copper and Iron Losses, the Primary Turns Being Variable.*

Instead of changing the losses of a transformer by impressing a variable voltage on its primary winding and keeping its output constant, the same result may be accomplished by varying the number of turns in the primary winding, keeping output, voltage and the volume of the copper constant. It is assumed that the frequency at which the transformer is operating is constant in both cases.

From an inspection of equation (3) it is apparent that an increase in the number of turns $N$ will decrease $B$ the induction in the core and consequently the core loss. Decreasing $N$, on the other hand, will increase the core loss. The total volume of the copper remaining constant, an increase in the total number of turns of wire necessitates a reduction of its sectional area and an increase of its length. If the turns are decreased, a shorter length of wire having a greater section results. As the resistance of a conductor increases as its length becomes greater and its cross-section less, the copper loss increases with the number of turns in the winding. On the other hand, a reduction in the number of turns decreases the copper loss. This shows that the copper loss varies in-

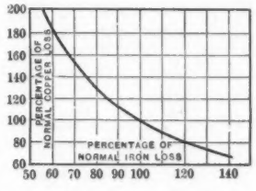



FIG. 3.—RELATIVE VALUES OF THE IRON AND COPPER LOSSES EXPRESSED AS A PERCENTAGE OF THEIR NORMAL VALUES.

versely with the iron loss. The exact relation between the losses may be determined as follows:

If $P_c$ be the copper loss, its value by definition is

$$P_c = i^2 r$$

where $i$ is the current in the windings and $r$ its resistance. Since the output of the transformer remains constant during the change in the relative values of the iron and copper losses, we may write:

$$P_c \propto r \propto \frac{l}{q}$$

where $l$ is the length of copper wire in the winding and $q$ its sectional area. As the number of turns of wire in the winding varies, it is assumed that the space-factor of the coil is constant. The space-factor may be defined as the percentage of the total space available for the winding actually occupied by the wires; in other words, as the sectional area of the wires multiplied by the total number of turns and divided by the opening in the core at right angles to the wires. As the number of turns in the winding increases, the insulation on the wires becomes a greater percentage of the total available winding section and thus the space-factor is not strictly constant as the turns vary. The space-factor does not change greatly for a limited variation in the number of turns, and it may be considered constant without introducing any considerable error.

Since the space-factor remains approximately constant, the total volume of the copper does not change and the sectional area of the wire necessarily varies inversely as its length. Therefore, the above equation may be written:

$$P_c \propto \frac{l}{\frac{1}{l}} \propto l^2 \qquad (10)$$

Since the mean turn of the winding does not change, the number of turns $N$ is proportional to the length of the wire $l$. Therefore,

$$P_c \propto N^2. \qquad (10)$$

Since $N$ is inversely proportional to $B$, from equation (3), this may be written:

$$P_c \propto \frac{1}{B^2}$$

This is the same relation as expressed by equation (4), since $E$ in that equation is proportional to $B$, when $B$ is caused to change by varying $E$ the impressed voltage. Evidently in both cases the iron loss is the same function of the induction and as a result the losses bear to each other the same relation as in the former case.

It may be stated as a general proposition that the relation of the losses is the same when they are varied by changing the impressed voltage as when they are varied by changing the number of turns while keeping the impressed voltage and the volume of copper constant. Assuming, of course, that the output remains constant in both cases.

*Variation of the Losses with Changing Frequency.*

In the preceding cases, the losses were assumed to be varied by changing the impressed voltage or the number of primary turns in the winding while keeping the output and frequency constant. It will be of interest to show the variation of the iron loss while keeping the voltage and output constant and varying the frequency of the supply circuit. The question is

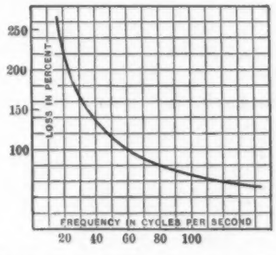



FIG. 4.—VARIATION OF THE IRON LOSS OF A TRANSFORMER WITH FREQUENCY AT CONSTANT VOLTAGE.

one of variable iron loss only, as evidently the copper loss is not effected by changing the frequency of the current.

Combining equations (2) and (3), and since $P_i$ is proportional to $p_i$,

$$P_i \propto f \left(\frac{E}{fNA_i}\right)^n$$

Since $E$, $N$ and $A_i$ are constant, this may be written:

$$P_i \propto \frac{1}{f^{n-1}} \qquad (11)$$

Fig. 4 shows the variation of the iron loss of a given transformer with the change in the frequency.

*Expression for the Volt-Ampere Rating of a Transformer.*

An expression for the output of a transformer, in terms of the various quantities involved, may be developed as follows:

Combining equations (2) and (3) we have:

$$E \propto fNA_i \left(\frac{p_i}{f}\right)^{\frac{1}{n}}$$

By definition:

$$\lambda = \frac{i}{q} = p_c^{\frac{1}{2}}$$

where $i$ is the current in the windings and $q$ is the sectional area of the wire in the windings. Combining the last two equations,

$$Ei = kva \propto p_c^{\frac{1}{2}}\, p_i^{1/n} qNA_i \frac{f}{f^{1/n}}$$

The product of the sectional area of one wire and the number of turns in the winding is equal to the total sectional area of the copper. By definition the space-factor of the winding may be expressed thus:

$$fc = \frac{qN}{A_c} \qquad (12)$$

where $A_c$ is the area of the total winding space in the core. Substituting the value of $qN$ from this relation in the above equation we have,

$$kva \propto p_c^{\frac{1}{2}}\, p_i^{1/n} f_c A_c A_i \frac{f}{f^{1/n}} \qquad (13)$$

A consideration of this relation shows that the output of a transformer is a function of the magnetic and current densities at which the iron and copper are working, the space-factor, the area of the iron and copper sections, and the frequency at which the transformer is working.

It is evident that with other things constant, the greater the densities at which the iron and copper are working, the greater will be the output of the transformer. It is also apparent that the greater the working densities in the iron and copper, the greater the iron and copper losses. The limit to which the densities may be increased is set for the core by the point of saturation of the iron and in the copper by considerations of heating.

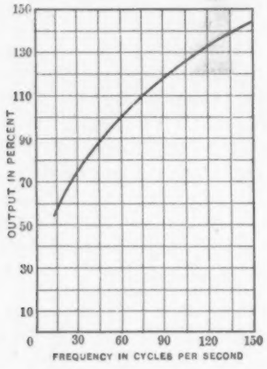



FIG. 5.—VARIATION OF THE OUTPUT OF A TRANSFORMER WITH CHANGING FREQUENCY, THE LOSSES REMAINING CONSTANT.

Equation 13 also shows that, other things being constant, the output of a transformer is related to the frequency of the supply circuit, such that,

$$kva \propto f^{1-1/n}.$$

Assuming that $n$ is equal to 1.7 this becomes

$$kva \propto f^{.41} \qquad (14)$$

The output of a transformer at, for example, 25 cycles, is 69 per cent of its output at 60 cycles. Fig. 5 shows the output of a transformer at various frequencies in terms of its output at 60 cycles.

*Relation Between the Output of a Transformer and Its Dimensions, Weight and Cost.*

If in equation (13) the values of the working densities in the iron and copper, the space-factor in the winding and the frequency at which the transformer is working are constant, it is evident that the output in kilovolt-amperes is proportional to $A_c A_i$ or

$$kva \propto A_c A_i.$$

Since each of these areas is proportional to the product of their dimensions, they are proportional to the square of one of the dimensions of the transformer. If one of the dimensions of the transformer be represented by $b$, then the product of $A_c A_i$ is proportional to $b^4$, then, on

$$kva \propto b^4 \qquad (15)$$

or the output of a transformer is proportional to the fourth power of its dimensions. For example, when the dimensions of a transformer are doubled its rating is four times its former value. This relation assumes that as the dimensions and rating of the transformer increase, its output is not limited by the heating of its core and coils.

Since the weight and cost of the active material in a transformer increase as the cube of its dimensions, from equation 15 one is able to determine the relation between its output, cost and weight. These relations are as follows:

$$kva \propto (\text{weight})^{4/3} \qquad (16)$$

$$kva \propto (\text{cost})^{4/3} \qquad (17)$$

*Relation Between the Output of a Transformer and Its Loss.*

The sum of the iron and copper losses of a transformer may be expressed in terms of its kilovolt-ampere rating. The sum of the losses $P$ may be expressed in terms of the iron and copper loss as follows:

$$P = P_i + P_c.$$

The weight of iron and copper in the transformer is proportional to the volumes of those elements. Since the volume of an object is proportional to the cube of its dimensions, assuming that the flux density in the iron and the current in the copper are constant, the sum of the losses varies as the cube of the linear dimensions of the transformer. It has been shown in equation (15) that

$$kva \propto b^4,$$

and since

$$P \propto b^3$$

$$P \propto (kva)^{3/4} \qquad (18)$$

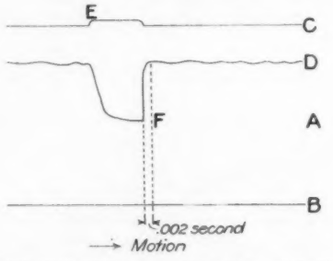
Equations (16) and (18) show that the weight and total loss of a line of transformers increase as the ¾ power of the output rating.

## Time-Constant of a Storage Battery.

By Sydney W. Ashe.

An investigation of the storage battery has been carried on by the writer at Columbia University during the past few months under the direction of Prof. F. B. Crocker. The purpose of this study was to determine if possible just how much time is required for the current in a storage battery to rise from zero to the normal operating value after closing the circuit. This question has been under discussion many times in cases where a storage battery is operating in parallel with a rotary converter and a short-circuit occurs. The question which arises is, will the time-constant of the rotary circuit be greater than the time necessary for chemical action in the battery to take place, and, if so, will the battery select the load more quickly than the rotary, allowing the circuit-breaker of the rotary to open before it flashes over the commutator?

With a view to arriving at a conclusion in reference to the time for chemical formation, rate of migration of ions, rate of diffusion of acid, time-constant of the battery or whatever may be the explanation of this apparent time-interval, a simple test was made with an oscillograph, obtaining a curve, a copy of which is shown herewith. A contact-maker was operated upon one end of the film carrier of the oscillograph, making four contacts per revolution, opening and closing the current circuit each time. The zero current and potential lines are shown at the bottom of the figure, $A$ and $B$, the potential on closed circuit being shown at $C$, and likewise the closed circuit current at $D$. The




TIME-CONSTANT OF A STORAGE BATTERY.

direction of motion of the film is from left to right; as the circuit is opened by the contact-maker the potential rises to $E$, the current falling to $F$.

The battery had a normal six-hour rate of discharge of 15 amp, and the current on closed circuit was maintained at this value. Slight irregularities in the brush contact are shown by the variation of the current curve. A small spark formed on opening the circuit accounts for the gradual fall of the current curve. The rise of current on making contact was very rapid, the time interval represented between the two parallel lines being 0.002 second. The time necessary for the potential to fall was about one-fourth as great as this value, which would seem to indicate that the time value for the current was even of a smaller magnitude than 0.002. This experiment seems to indicate that the time-interval of the battery is much smaller than that of the generator or the converter.

# CENTRAL STATION

## MANAGEMENT, POLICIES AND COMMERCIAL METHODS

### A Large Plow Factory Motor-Driven.

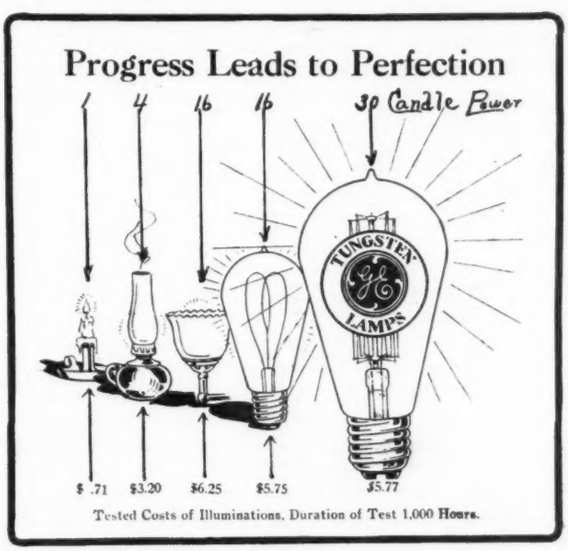
The Moline Plow Company, of Moline, Ill., is changing its entire factory from drive by engines and long line-shaft to group drive with electric motors. There will be over 3200 hp in induction motors. All of the wiring will be placed in conduit, which is unusual for mill work of this kind. The contract is being carried out by the Electric Construction & Machinery Company, of Rock Island.

### Electric Arch for Denver.

The business men of Denver, Col., have secured the co-operation of the City Government in the construction of an electric arch at First Avenue and Broadway. The contracts for the construction and lighting of the arch were drawn up at a recent conference between the business men and the City Attorney. The arch, which will be built by the Denver Gas & Electric Company, will be about 35 ft. high, spanning 65 ft., and constructed of iron and steel. There will be 800 lights, and the city will pay half of the cost for operating them. This represents the beginning of the extension of general lighting schemes in the southern part of Denver.

### Central-Station Advertising.

The Danville (Ky.) Electric Light, Power & Traction Company has for some time been conducting a "new business" campaign, in which circulars, newspaper advertising and night lantern projections have been effectively employed. The accompanying illustration is reproduced from a lantern slide which was used for a week, the projection being received on a house-top screen and also on the stage curtain of the local theater.




LANTERN SLIDE FOR CENTRAL-STATION ADVERTISING.

### Electric Power for Water Pumping.

The Northern Colorado Power Company, which has for its particular field the irrigated agricultural territory from Boulder to Fort Collins and Greeley, has been gradually undertaking a considerable business in water pumping for irrigation purposes. This has proved so satisfactory both in the obtaining of a full load curve and to the farmers in making otherwise arid land, which could not be placed under ditch, fertile, that the power company is now entering an extensive campaign for this kind of business. The average lift is from 10 ft. to 20 ft., though in some cases by lowering the level of the pump, water is lifted profitably over 30 ft. Instances are given where dry land valued at $15 per acre has been increased to $150 per acre, with a cost for irrigation not much more than the maintenance charges on the average ditch.

### Electric Heating at the Michigan Convention.

One session of the Michigan Electric Association convention, held at Detroit in August, was given to a consideration of electric heating, which was the subject of a report from the electric heating committee of the association, consisting of Messrs. William Constable, H. A. Mott and R. W. Hemphill, Jr. The report noted a steady increase in the introduction and sale of the popular devices. Flatirons still lead, as they did last year, and will probably continue to do so. A large number of good irons are now on the market—that is, irons with resistor units easily renewed and of longer life than heretofore. The toaster seems to be second in the list of popular devices. Its simplicity and cost make it more popular every year, and it is believed that the central station may derive a healthy revenue from this little device, owing to its frequent use in the household and low cost of operation. Percolators, chafing dishes, water heaters and other small devices occupy about the same position as last year. The first cost and infrequent use of these devices by the general public prohibit the universal sale afforded the flatirons.

No rapid advances have been made in the fireless cooker, probably on account of the Fire Underwriters' rules. Manufacturers have been busy improving the present devices. It is believed that industrial electric heating is in its infancy, and being comparable with the situation as regards the electric motor for industrial purposes 10 years ago. The commercial development of new alloys and improved electrical insulators will greatly enlarge the possibilities of industrial heat applications.

In Michigan there are a number of electric welders in use. The development of spot and point welding and of the automatic punch press welders, where unskilled labor may be used, is a marked advance in the art of electric welding. This device appeals especially to those whose products are manufactured from sheet metals. Foundries offer a large field for the use of the electric arc in repairing cracked or defective castings. The fuse-bath type of electric furnace for heating steel before tempering has proved its great merits, as has also the oil-tempering bath for the manufacture of dies. One large electric manufacturing company has developed a very satisfactory machine at a reasonable cost. Printing, publishing and bookbinding trades offer a large field for the use of electrically heated machines. The matrix table offers the greatest field, owing to the elimination of the high-pressure steam boilers necessary for their present operation. Glue-pots and glue-cookers offer a great inducement to woodworking concerns, which otherwise would have to install an intricate steam piping system throughout their factories. The leather trade offers a large field for electrically heated tools on account of maintaining a constant temperature in comparison with flame-heated tools. In the clothing and textile trades electric irons have displaced all others in many of the larger clothing factories.

Mr. J. D. A. Cross, of the General Electric Company, presented a paper on "The Extension of the Heating-Device Business." He called attention to the installation in a prominent

hotel in the West of a complete kitchen and laundry equipment. It is estimated that the consumption of power during the preparation of meals will vary between 30 kw and 75 kw. There is an 85-kw electric steam boiler, which supplies energy to the laundry mangle and other laundry devices. Nearly every central station now appreciates the possibilities of increasing the day load by selling electric irons. While most irons have been sold during the hot months, their use may be extended through the year. The campaign for irons should be supplemented by one for toasters for household use.

Mr. Cross thinks that the vertical radiant-type toaster will develop into a more standard and profitable device than the flat-iron after consumers have been educated to its simplicity and practicability. The consumption of these on an average use for 20 minutes per day would amount to 6 kw-hours per month. After the toaster has been installed for a while the customer will be convinced that cooking by electricity is practical and simple, and other devices will be employed.

Mr. Cross called special attention to the oil-tempering bath for tools. The close regulation which is necessary with oil tempering can only be successfully obtained by the use of electrically heated baths. The electrically heated oil-tempering bath can be obtained in three sizes, having a capacity of from 9 gal. to 37 gal. of oil and having a consumption of from 6 kw to 20 kw. This power is sufficient to heat the oil to a temperature of 450 deg. Fahr. in less than one hour, starting cold. The bath is equipped with means of heat regulation, making it possible to raise the temperature to 250 deg. Fahr., after which the "work" is introduced and the temperature is then raised to the desired point. This device will be welcomed by all who temper steel, whether they be manufacturers of steel tools and implements or whether they temper tools and dies for use in their own manufactures.

There will be placed on the market this fall an attractive and varied line of ornamental chafing dishes, percolators and disks for holiday trade, and an unusual effort will be made for holiday business. He favored the raising of prices on the sale of electric heating devices to protect local dealers, and if possible to make a working arrangement with them. He also urged central stations to look well after the maintenance of heating devices, in order that these devices may be kept in constant use and not put aside for lack of repair. The cost of this maintenance can be compensated for by an increase in the selling price.

DISCUSSION.

Mr. H. J. Mauger, of the General Electric Company, predicted that the successful electric range of the future would be along the lines of the gas range in connection with the fireless cooker. Recent improvements make it possible to get higher temperatures than formerly. With electric heating units which can withstand 40 watts per square inch, the rate of heating will be equal to that obtained with gas, and the electric unit can compete with the gas flame. The new resistor metal developed by the General Electric Company known as "Calorite" has twice the resistivity of German silver, and can be operated at a temperature of 1200 deg. C. A small stove made with this material has only 0.003 in. of mica between it and the surrounding metal to which the heat must be conducted. Such a disk can be run at 900 deg. C. with a consumption of 40 watts per square inch. The old type of 9-in. or 10-in. disk stove could not safely be made to take more than 15 watts per square inch. It is expected that there will be available for next season an electric range in which the heating elements will be permanently mounted on the range.

## Curve-Drawing Meters.

One of the features of the convention of the Michigan Electric Association, held at Detroit in August, was the consideration given to the subject of curve-drawing instruments as applied to motor and lighting circuits of consumers. Several papers were read on this subject.

Mr. J. M. Van Splunter, in a paper on "Curve-Drawing Instruments and Some of Their Applications," said that in the power equipment of factories and in the records kept, electrical instruments make it possible to show the distribution of the load over the factory, the power used per machine, the character of the load, the condition of the cutting tools and the time to complete different operations. To obtain these results data obtained from the records of curve-drawing instruments are so complete that the situation can be sized up in every detail and the necessary changes and corrections made at the proper point. Up to within the last few years it was the practice to install a single prime mover which furnished power for the entire plant by means of numerous shafts and belts. This practice is gradually being changed to that of installing a separate motor for each machine. By using curve-drawing instruments it is possible to show just how much power each machine takes, how long it is in use each day and the cost of energy for its operation. Such records also show with what promptness the employees start to work in the morning and their time of shutting down. Furthermore, they tell when it is necessary to install new machines, and when by some changes fewer machines can be made to do the required work. In other words, the instruments can be used to check the efficiency of the employees, as well as that of the machines. If each central station would procure a curve-drawing wattmeter for demonstration purposes, it would soon result in numerous motor sales, as the record would show the actual conditions throughout the day. The writer recently visited one of the largest power companies in Michigan, which is continually using four curve-drawing wattmeters for this purpose, and its success in the motor field amply justifies the position it has taken in their use.

An example of its use is very interesting as showing conditions that were wholly unexpected: A curve-drawing wattmeter was installed at a place where the customer insisted that the energy used and the energy paid for were at a variance. The record for the day was normal, but a rise in the curve at 9:30 at night could not be accounted for. It was found that the night watchman was in the habit of using all the elevators when making his nightly inspection, and thus the extra energy used was checked.

Another instance, in a department store, was also very striking: The customer complained of excessive bills, and after a curve-drawing instrument was installed, the record showed that there was more energy consumed at night than during ordinary business hours. This was also found to be due to the watchman using the lamps during his rounds. In this manner the instrument not only showed how much energy was used, but also when the energy was being consumed.

It is a well-known fact that in a factory driven by steam engines through a system of line shafts and belts that it is a very difficult thing to ascertain the efficiency of a department, and even that of a single machine. This is not so, however, with the plant electrically driven. The efficiency of the entire plant, any department, or combination of departments, or even groups of machines, or single machine, can be very easily ascertained by electrical measuring instruments, and most readily so by curve-drawing instruments.

DESCRIPTIONS OF CURVE-DRAWING INSTRUMENTS.

Mr. Paul MacGahan presented a paper giving descriptions of the principal types of recording meters. He classified such meters as, first, those in which simplicity and low first cost have been determining factors; and second, those in which accuracy has been made the prime requisite. Unfortunately, the qualities of simplicity and accuracy are still more antagonistic in recording meters than in indicating meters. The purchaser of meters of either type should consider whether an easily manipulated rough-and-ready instrument of a low order of accuracy is sufficient, or whether instruments of precision are needed. Until recently recording meters were limited to the simple cheap class which lacked accuracy. These usually have a stationary coil attracting a movable iron armature actuating directly an arm fitted with a pen. The pen travels in the arc of a circle across a circular dial plate. Taking up the second class, of high cost and accuracy, he said that it is absolutely necessary

to separate the functions of the measuring element and of the marking device, because the friction introduced by the pen on the paper interferes seriously with the accuracy. Some of the schemes which have been utilized for overcoming this difficulty are as follows: (1) Making a continuous photographic record of the position of the pointer, as in the oscillographs; (2) allowing the bent arm of the pen to swing slightly above the paper and to make a dot at fixed intervals by means of an electromagnet; (3) causing a high-tension discharge or spark to pass from the pointer through the paper; (4) the relay type. The second and third schemes are of little importance at present. The relay type, both in this country and abroad, appears to be a good solution of the problem. The meter is separated into two interdependent elements, the meter element or measuring coils and the motor element or pen-oprating device. These elements are connected by the control spring of the meter.

The function of the meter element is limited to making and breaking contacts, which energize the pen-actuating element. Thus the meter element need not have any greater torque than that of an indicating meter; it can, moreover, be made as accurate electrically as any indicating meter. On the other hand, the pen-actuating or motor-element derives its power from a separate source and can have as much torque as is necessary to control the pen. The chart may be made as broad as desirable, and in this way an instrument of high accuracy is obtainable.

DISCUSSION.

Mr. H. W. Hillman, of Grand Rapids, produced the record of the curve-drawing wattemeter from the department store spoken of in Mr. Van Splunter's paper, from which it appeared that the janitor used 19 kw-hours in lighting while sweeping, as against 7 kw-hours used during business hours.

Miss Sarah M. Sheridan, contract agent of the Edison Illuminating Company, of Detroit, said that the Detroit Company had user curve-drawing instruments both to determine the character of the demand made by motor users and also to show lighting customers just when and how much energy was used. She wished that all customers would purchase such instruments for their own information, but thought that very few would do so. The Detroit company has about 2200 customers having motors rated at from 8 hp to 15 hp. Of this class she thought few would purchase such instruments. Some of the larger customers might be persuaded to do so. In some cases the company had found it possible to satisfy complaining electric lighting customers by reading the watt-hour meter twice a day—morning and evening—to show when the energy was used.

Mr. B. J. Denman, of Detroit, expressed himself as not being as enthusiastic about the extensive use of the higher-priced recording instruments as were the former speakers. He thought that the cheaper instruments of the Bristol type, giving approximate indications, would answer most purposes. A few customers in Detroit buy primary energy and use their own transformers. Such have fairly complete switchboards and might purchase recording instruments. The use of energy by janitors can be detected by cheap instruments or by reading the regular consumer's watt-hour meter night and morning. He reported one case in which an amount equal to 60 per cent of the consumption used during business hours was used outside of business hours. Miss Sheridan said that the Detroit companies had three or four curve-drawing instruments for temporary use on consumers' premises. Mr. Denman explained that the rate made in Detroit, known as the "demand rate," was based on the maximum hourly demand as taken by hourly readings of the watt-hour meter. On one or two consumers the Chicago printing attachment will be used to take this hourly reading.

Mr. Hillman emphasized the point that curve-drawing wattmeters used in connection with the electric drive in factories give information which cannot be obtained in the steam-driven factory, and that the more this advantage is appreciated by manufacturers the more favorable will be their general sentiment toward electric service.

# INTERIOR WIRING AND ILLUMINATION

## Mammoth Moving Sign at Detroit.

The Campus Martius, in the heart of Detroit's business district, was recently packed with people on the occasion of the starting of an enormous sign of an unusual character built by the R. R. Sign Company, of Dayton, Ohio. This sign is reported to contain 11,000 lamps, and is located just south of the Detroit City Hall, facing the Campus Martius. The striking feature of this sign is the moving-picture effect obtained by means of flashers. The moving picture is that of a chariot race with one chariot with its team of horses in full view and another close behind. After this race is continued for a few seconds an advertisement of one of "Detroit's leaders" is flashed out at the top of the sign. These advertisements are changed after every chariot race in regular order. The sign is equipped with colored lamps, and the effect is beautiful as well as striking. A similar sign was previously erected at Dayton, Ohio. It is impossible by means of photographs to give any adequate idea of this striking piece of work.

## Spectacular Lighting During Firemen's Convention at Poughkeepsie, N. Y.

The Volunteer Firemen's Association of the State of New York held its annual convention in the city of Poughkeepsie during the week ending Aug. 21, and in order to make the event commemorative in the annals of the organization, as well as

FIG. 1.—MUNICIPAL BUILDING AND HOOK AND LADDER HOUSE.

those of the city, the historic town on the east bank of the Hudson underwent quite a transformation. The buildings were bedecked with flags and bunting in profusion; but the feature of the entire decorative scheme was the electric illumination at night, the like of which was never before witnessed on the famous river. Portions of Main and Market streets were transformed into a great "White Way," the culminating feature of which was the Court of Honor on Market Street. Barring some minor changes, the latter was the same as that used in the pageant attending the inauguration of President Taft in Washington this spring. In addition many merchants had arranged individual electrical displays of decided merit.

It is estimated that some 20,000 lamps were used in the decorations. Main Street, from Washington to Hamilton streets, was brilliantly lighted by duplicate rows of lamps festooned from poles spaced 100 ft. apart on both sides of the roadway. The Elblight system was employed throughout. A view of

Main Street, as well as some of the individual decorated buildings on the thoroughfare, are shown herewith. Fig. 4 shows a rather poor view of the Court of Honor on Market Street. On the top of each of the huge columns were large flower baskets made of wicker work, with electric lamps placed in each of the apertures. The lamps were vari-colored, and with the foliage gave a very pretty effect. Swinging from column to column were festoons of lamps running parallel and transversely with the street, as shown in the engraving. The lamps were supplied with electricity from air-cooled transformers erected on poles especially for the occasion, and were controlled from switches on these poles. The transformers used were rated at 35 kw each.

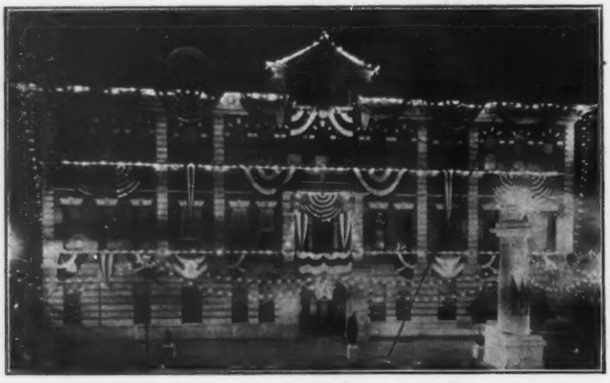


FIG. 2.—COURT HOUSE AT MARKET AND MAIN STREETS.

FIG. 3.—GENERAL VIEW OF LOWER MAIN STREET.

The Poughkeepsie Light, Heat & Power Company, whose office is on Market Street, also made an elaborate display, as did also the Poughkeepsie City & Wappinger Falls Electric Railway Company. The car barn of the latter company was brilliantly illuminated by a large electric star and ropes of incandescent lamps. Fig. 5 is a view of the office of the lighting company as it appeared during the celebration. Much of the credit for the entire electric illumination in the city during the convention is due to Mr. G. A. Voorhees, superintendent of the lighting company, who also had personal charge of the installation of the Court of Honor. An effort is being made by some of the merchants to have portions of the business district permanently lighted in a manner somewhat similar to that employed during the firemen's convention.

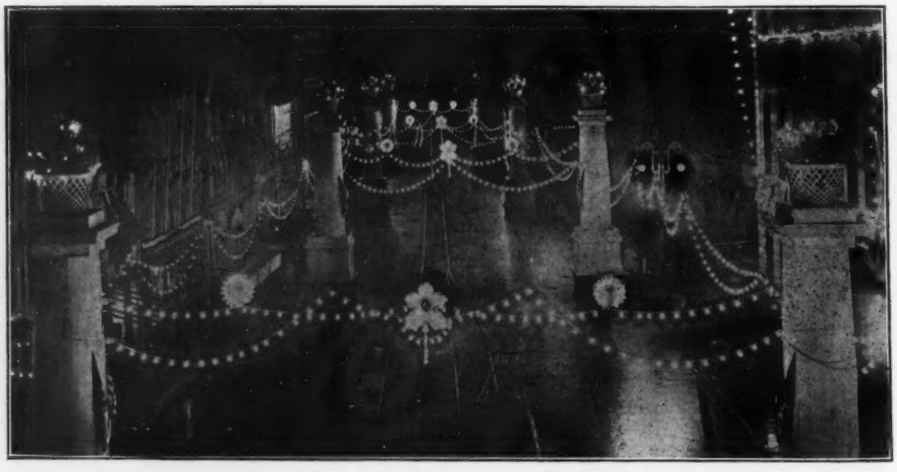


FIG. 4.—COURT OF HONOR, ON MARKET STREET.

## Lamps and Illumination at the Michigan Convention.

A number of short papers were presented at the convention of the Michigan Association, in August, at Detroit, on tungsten lamps and illumination. One of these, "The Tungsten Lamp in the Residence," was written by Mr. John Vandervliet, of Grand Rapids, who called attention to the unsuitability of ordinary fixtures for tungsten lamps and the idea of the fixture manufacturers in the past to make fixtures with graceful curves that would appeal to the public regardless of the results the customer would get in lighting. In most of the cases he had personally investigated in residences Mr. Vandervliet found that the lamps were hung at an angle of about 45 deg. with a close-fitting frosted or colored shade, and often in addition to this a frosted lamp. In one case the consumer had combination fixtures in which the gas burners were equipped with large white polished reflectors to catch and redirect the light coming from the mantle, while the electric lamps were surrounded by small frosted shades. He showed the consumer how the electric lamps were very unfavorably equipped to deliver useful light, while the gas lamps were well equipped. To show the customer that it was possible to get excellent distribution from the same fixture with electricity he used three 40-watt tungsten lamps with prismatic reflectors, using tungsten adapters to place the lamps in a downward position. With any one of these lamps the customer could read better than with one gas burner. The customer was pleased, and made no further complaints. The company does not wait for complaints, but has two men who make a systematic canvass of residence customers with the above-mentioned combination which they install in a reading-room to be left on 30 days' trial. In nearly every case the customer sees enough improvement to warrant the purchase of the outfit. Mr. Vandervliet believes that the tungsten lamp is the salvation of electricity as against the gas mantle in the home. Nothing smaller than a 40-watt lamp is used at Grand Rapids in this work.

Mr. E. G. Bieg, of the General Electric Company, read a paper on "The Supremacy of the Tungsten Lamp." He said that this fortunate heritage to central-station interests has come none too soon to enable them to hold their own in the field of lighting in competition with the improved methods of using gas, gasoline and acetylene. One difficulty in electric lighting has been, not the cost to the consumer, but that the returns obtained for the expenditure were so meager as compared to gas and other illuminants as to be a serious handicap to electric lighting. The tendency in illumination is to increase the volume and amount of light used, and the tungsten lamp

gives the increase and improvement which are desired. The filaments employed in the various sizes of tungsten multiple lamps run from 0.001 in. to about 0.0055 in. in diameter, and larger. A human hair has a diameter three times as large as that of the filament used on the 25-watt lamp. The comparative intrinsic brilliancy in candle-power per square inch of filament area is about 100 for tungsten as compared to 440 for carbon. It requires 30 to 40 times as long to exhaust a tungsten lamp as it does a carbon lamp. All metallic-filament lamps rise rapidly in candle-power the first few hours of burning. Tungsten lamps are therefore seasoned by being placed on racks and burned for a limited period at excess voltage, so that the lamp will not operate at a higher rating than normal when started in service. The first cost of tungsten lamps is less than that of the early carbon lamp. The life of the tungsten lamp is so good at normal rating, running well up to 1000 hours or more, with well-maintained candle-power, that it is unnecessary to order lamps of excess voltage to insure satisfactory service, as many customers felt was necessary with the first lamps.

In no form of tungten lamp has its success been so marked as in the case of the street series type. This lamp competes successfully with gas street lamps in the matter of cost, with all the superior advantages of the electric incandescent lamp for such service. The life of the tungsten street series lamp is from 1500 to 2000 hours in service. The lamp can be depended upon to give a brilliant light until it fails, with small depreciation in candle-power. The introduction of the tungsten series lamp has already doubled the sales of street series lamps, and over 85 per cent of the incandescent lamps used at present for street series work are tungsten lamps.

The 4-cp, 5-watt sign lamp has been developed. Data obtained show an average life of over 1500 hours, which is at least equal to if not better than the carbon sign lamp. The maintenance of candle-power is very much better than with the carbon lamp. The lamps are made for 10, 11 and 12 volts, so as to burn 10 in series on commercial direct-current circuits. On alternating-current circuits they are usually burned in multiple with a transformer having a 10 to 1 ratio. Consumers who have wanted to advertise by means of an electric sign and have been unable to do so owing to the cost can now do so at the ordinary rates for electricity. Customers now using carbon lamps can, by substituting tungsten lamps, be induced to light their signs longer every night, as it will cost no more, and this results in a better character of load for the central station.

Mr. B. F. Fisher, Jr., of the Westinghouse Lamp Company, also presented a paper on tungsten lamps. He said that the tungsten lamp appeared fully developed and a commercial success in less than two years. It is being made in sizes of 25, 40, 60, 100, 150 and 250 watts for voltages from 100 to 125 and in sizes of 45 to 50, 70 to 80, 110 to 120, and 180 to 200 watts for voltages from 200 to 250. Spectacular and sign lighting are taken care of by the 10, 11 and 12-volt, 5-watt sign lamp.

Street series lamps are made in 25, 32, 40, 60, 80 and 200 cp. Train-lighting lamps for voltages from 28 to 34 are made in 12, 20 and 32 cp, and for voltages from 58 to 65 in 12, 16, 32 and 40 cp. Nearly 100 different tungsten lamps have been successfully developed in these two years of commercial tungsten history.

Mr. J. R. Cravath, of the *Electrical World*, gave a talk on illumination, with reference to the use of tungsten lamps. He gave special attention to recent advances in illuminating engineering knowledge, and pointed out that it is no longer necessary to advocate before a body of central-station men the use of proper reflectors or directing devices upon incandescent lamps used for general illumination. The use of reflectors has become general with the introduction of the tungsten lamp. However, the proper type of reflector is not always selected, and for that reason he called special attention to the necessity of selecting a reflector giving the kind of distribution needed for the room under consideration.

For the general lighting of rooms he condemned the use of flat reflectors which exposed a large portion of the lamp filaments. Such reflectors were used in considerable quantities in the days when the graphitized lamp was first brought out. They were known as the distributing type. There are also a number of clusters on the market at present employing flat reflectors. For general lighting of rooms such reflectors are deficient in two respects. A considerable portion of the flux of light from an incandescent lamp in a pendant position is given off at angles near the horizontal. Flat reflectors fail to intercept and redirect this flux of light. It consequently strikes the upper part of the walls of a room and must be reflected back and forth between the walls many times before reaching the working plane where the illumination is most desired. This multiple reflection between the walls causes excessive loss, especially if the walls are dark. The other defect of these reflectors is that they do not shade the lamp filaments from the eye. The bare filaments produce a partial blinding effect which makes the effective illumination appear less to the persons in a room.

It has been found that with bowl-shaped reflectors which completely cover the incandescent lamp it is possible to obtain any kind of light distribution desirable in ordinary general lighting of rooms. There reflectors are made in forms which are

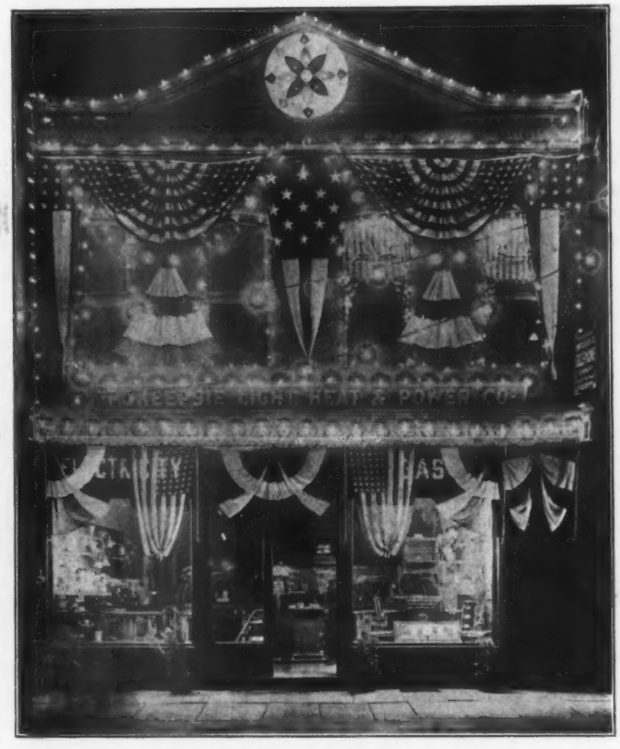


FIG. 5.—OFFICE OF POUGHKEEPSIE LIGHT, HEAT & POWER COMPANY.

very concentrating and also in forms which give a wide distribution. He cautioned his hearers against using reflectors giving the wide or extensive type of distribution in high, narrow rooms with dark walls. In such rooms a concentrating reflector should be used. The general principle should be followed that as much light as possible should be prevented from striking dark walls where it will be lost by absorption. Any type of reflector which causes a considerable portion of the flux of light to be directed against dark walls is likely to be inefficient. For this reason concentrating reflectors must usually be used where the lamps are at great height, especially if the room is narrow.

A considerable advance has been made in three years in reflector manufacture. Three years ago the only scientifically designed line of reflectors on the market was of the clear prismatic type. There is now an increasing number of designs in opal, prismatic with enameled and satin finish, and opal with various satin finishes. The number will doubtless be increased as various manufacturers of glassware come to appreciate the importance of scientific design of reflectors. Among the

opaque reflectors available are the one-piece corrugated mirror reflectors, the mirror reflectors made up of many pieces or sections, the aluminum reflectors, steel reflectors with aluminum finish, and white enameled reflectors.

As a result of numerous tests on the illumination of various rooms in the past three years, engineers now have a much more definite idea than formerly as to the results which can be obtained with a given expenditure of electrical energy. Mr. Cravath showed a compilation of over 150 tests made on the illumination of various rooms in various ways, which indicated that illuminating engineering is coming to be an exact science, as far as measured illumination is concerned. He called attention to some of these figures which show the very important influence of the color of ceiling and walls on illumination. The results obtained by Messrs. Lansingh and Rolph in a given room with the same lamps gave a difference in illumination under extreme conditions in the ratio of 4½ to 1. In a room with dark ceiling, walls and floor, with one bare lamp at the ceiling, 0.77 watt per lumen (watt per square foot per average foot-candle) were obtained, while in a room with light ceilings, walls and floor and with a reflector over the lamp, 0.16 watt per lumen was obtained.

After all, the author said, illumination is not altogether a matter of measured foot-candles, but of measured foot-candles combined with avoidance of blinding effect and annoying shadows. He took up the points to be observed to secure efficiency with indirect lighting, and showed that the same principles must apply as in direct lighting—namely, the avoidance of excessive loss by allowing too much light to escape to the walls of a room. Cove lighting is inefficient because of excessive loss on the walls. Lighting from central fixtures which are made to direct most of the light against central areas of a ceiling can be made much more efficient. The efficiency of the latter kind of installation will depend much upon the reflectors and on the distance of the lamps from the ceiling. If the lamps are hung too low, too large a percentage of the light directed to the ceiling leaves the ceiling at angles which cause the rays to strike the walls and cause loss. The aim should be to have as much as possible of the light directed from the ceiling straight to the working plane without having it undergo several reflections from the walls.

In the discussion which followed, Mr. A. C. Marshall, of Port Huron, said that his company had almost completely tungstenized the store lighting of Port Huron. In some cases there was a reduction in bills the first month after the change was made. On the whole, there had been no reduction in revenue. In regard to the advantages urged for the 4-cp tungsten sign lamps he called attention to the fact that in many cases a 2-cp lamp will make a more legible sign that the 4-cp lamp; large numbers of such 2-cp lamps are being used in signs both in Port Huron and Detroit. The saving claimed for the 4-cp tungsten sign lamp would therefore be divided by 2 in competition with 2-cp carbon lamps.

Mr. E. F. Phillips, of Detroit, speaking of the effect of the tungsten lamp on the business in small towns, said that it had brought a wonderful increase in business because of the consumers who used other illuminants than electricity. There was also a small decrease in some consumers' bills at first.

Mr. Harry Fee, of Adrian, told of the campaign his company had carried on under the motto, "Watch It Grow—Tungsten." While Adrian had been formerly very much given over to the use of gas, the situation as regarded relative use of gas and electricity had been reversed. As to street lighting, his company now has a contract to supply 110 series-tungsten lamps, of 40 cp each, at $19.80 a year. These had been placed up in competition with inverted gas-mantle burners which the gas people had claimed would give 125 cp. His company had claimed only 40 cp for the series-tungsten lamp, but the depreciation in gas mantles and pressure variations brought the candle-power of the gas lamp so low as to make the claims of the gas people seem absurd. Another gas-mantle burner for which extravagant claims were made was also tried. Since both fell so far short of the claims made, and appeared to give less actual illumination than the 40-cp series-tungsten lamp, his company received the contract.

## A Notable Example of Indirect Lighting.

The lighting of the new ballroom of the South Shore Country Club, at Chicago, has attracted much favorable comment in the short time since it was completed, and is one of the most notable examples of indirect lighting for a very large area to be found in this country. The total floor dimensions of this ballroom, a general view of which is shown in Fig. 1, are about 86 ft. x 136 ft. The dancing floor proper is about 62 ft. x 112 ft. Around this dancing floor is a promenade 12 ft. wide. The ceiling above the dancing floor is 28 ft. high, and the ceiling of the promenade 20 ft.

The large central area, or dancing floor, is lighted from three fixtures. Each of these three fixtures contains 23 tungsten 100-watt lamps, each equipped with a bell-shaped corrugated one-piece mirror reflector pointed up. The fixtures are of composition, finished in old gold and lined with red silk, which shows through the open work of the fixture baskets.

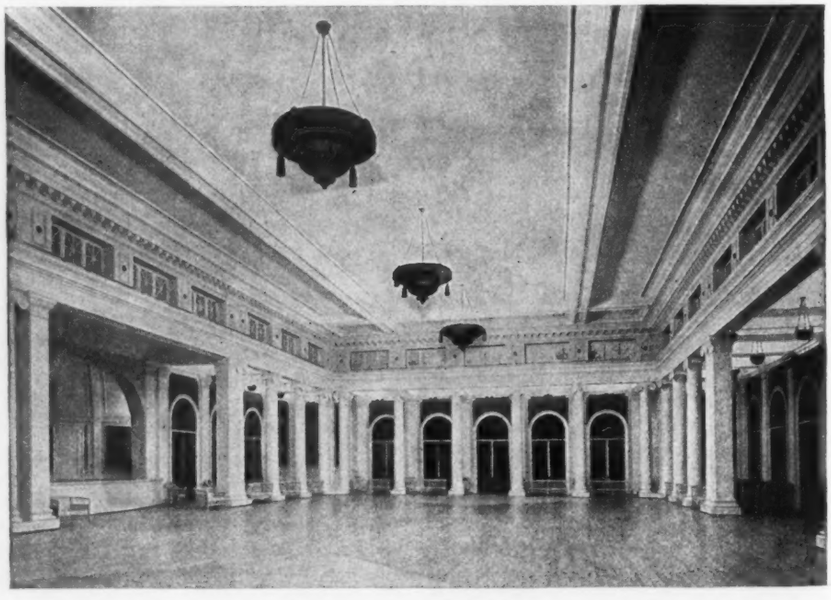


FIG. 1.—VIEW OF BALL-ROOM.

Over the promenade around the dancing floor there are 28 fixtures, each containing one 100-watt tungsten lamp equipped with similar reflectors. These one-lamp fixtures harmonize in general design with the large fixtures over the dancing floor. In the lobby, or hallway leading to the ballroom from the main club building, there are nine one-lamp fixtures.

The large fixtures are 63 in. in diameter and are hung with the top of the basket 6 ft. from the ceiling, this ceiling distance being that calculated to give the best results. The fixtures over the promenade are 36 in. from the ceiling. In this case the fixtures were hung a little lower than the proper distance to give the best illuminating results in order to better fit in with the architectural design.

The central area or dancing floor uses about 1 watt per square foot. The total area—that is, the dancing floor and promenade—uses 0.83 watt per square foot. The average illumination with the installation now is estimated to be an average of 2.3 foot-candles, although no measurements have been taken.

The results exceeded the expectation of the board of gover-

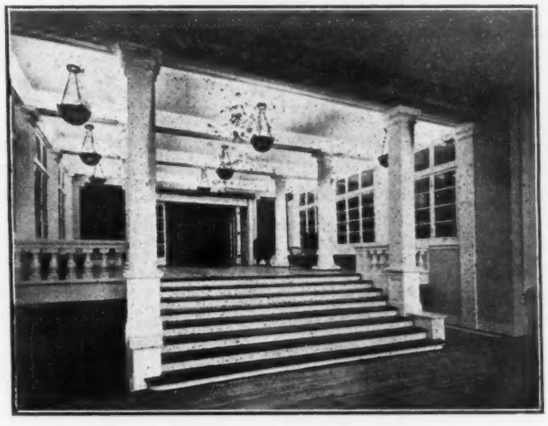


FIG. 2.—LOBBY.

nors of the club, and are free from the objectionable flatness which accompanies indirect lighting by the cove method. One notable feature of the illumination is the ease with which persons can be seen at a distance across the floor, presumably because of the absence of exposed lamps in the field of vision.

The baskets of the fixtures which hold the reflectors are somewhat larger than needed for the reflectors in the case of

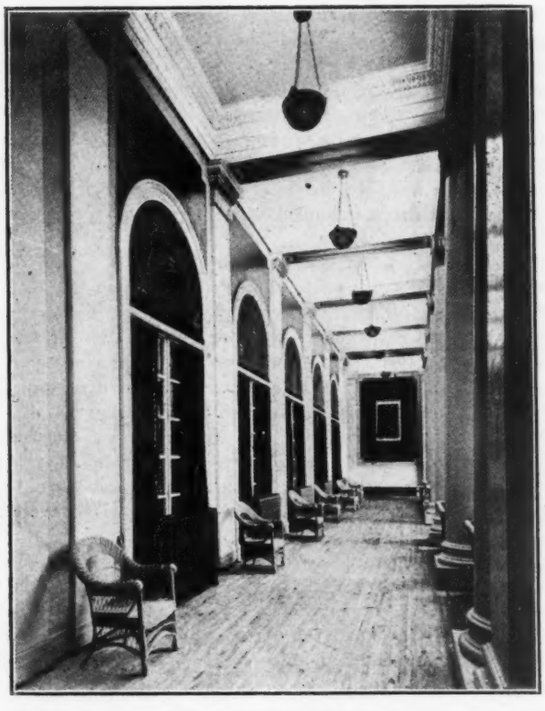


FIG. 3.—PROMENADE.

the one-light fixtures, and this permits some reflected light from the ceiling to shine back through the silk lining and softly illuminate this silk so that the design does not appear black and dead. The same thing is accomplished in the large fixtures by the light which shines through from the ceiling between the reflectors. The ceilings are very light in tint. The walls are "American Beauty" red. The illuminating engineering was done by Mr. J. R. Cravath, of Chicago. The reflectors used were made by the National X-Ray Reflector Company, of Chicago. The architects for this ballroom are Messrs. Marshall & Fox, of Chicago, and the fixture designs were made by them.

## New Telephone Patents.

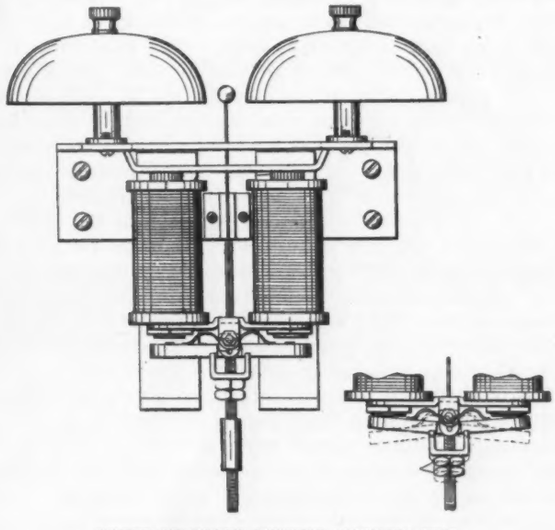
SERVICE METER CIRCUIT.

Where the service meter system of charging is in use it becomes necessary to provide a counting device for each line which may be actuated by the operator to count one call for each completed connection. For three-wire systems the meter may be included in the sleeve or cut-off relay circuit, but it must fail to operate upon the normal currents of this circuit, while its special operating current must not injure the other apparatus. Some consider it an advantage to have the service meter lock upon the normal cut-off current, after being once operated. It is with this type of meter that a patent granted to Mr. W. Reid, of Chicago, Ill., is concerned. Mr. Reid puts two differentially connected windings upon his meter and thus there is less tendency for the meter to respond to normal currents. On the other hand, the lock circuit shunts out one of these windings, making it easy to lock up the meter. This patent is assigned to the Kellogg Switchboard & Supply Company.

NEW APPARATUS.

A patent has been granted to Mr. J. Erickson, of Chicago, Ill., on a tubular-type relay, one side of the shell being flattened to afford a seat for the mountings for contact springs and also to afford a knife edge or corner for the hinge point of the L-shaped armature. This latter has a part of its spring actuating leg cut away so as to permit a small clip, screwed to the relay shell, to extend over its vertical leg in a manner to secure the armature in position.

Mr. B. W. Sweet, of Cleveland, Ohio, patented and assigned to the Century Telephone Construction Company a removable coil drop for use as part of a combined drop and jack. The steel drop shell is open at the rear, and the coil slip within, having bent lugs which register with screw binders on the proper jack springs, so that no soldering need be done. The drop armature carries a stationary spindle, which drops into



SWEET SELECTIVE RINGING MAGNETO BELL.

open slot bearings, being then secured by small movable hooks. Above is shown a ringer for selective work, also the invention of Mr. Sweet. It is designed for harmonic selection. The armature is two-part and is carried upon a frame which in turn is attached rigidly to a spindle. This latter is clamped at the end of a flat spring extending down from the framework. The armature is adjustable, thus controlling the air-gap; two polar-

izing magnets are used. The cut shows clearly the arrangement.

Messrs. C. O. Sisler and L. D. Smiley, of Uniontown, Pa., have jointly patented an apparatus for the step-by-step control of a party line upon the lock-out basis. The patent covers largely details of arrangement and construction.

# Letters to the Editors.

## Movement of Magnetic Material in a Rotating Field.

*To the Editors of Electrical World:*

Sirs:—In your issue of July 22, on page 204, there appears a letter regarding an experiment with a rotating field and two sets of uniformly shaped iron filings and iron disks on edge, free to revolve or turn, on non-magnetic plates placed one above and one below the horizontal plane of the rotating field. Reference is made to the action of the iron pieces on the upper plate tending to revolve in a direction opposite to, and those on the under plate in a direction with, the rotating field. An explanation is given on page 180 based on the hysteretic action in the iron pieces, which, however, in the writer's opinion, is not of sufficient magnitude to cause the effect described.

A logical explanation would be that the tangential pull of the rotating field acting at the lower periphery of the top set of iron pieces and at the upper periphery of the under set of iron pieces, shown in illustration, causes a natural tendency in the two sets of iron pieces to revolve or rotate in relatively opposite directions.

Madison, Wis. C. W. Lange.

## Printing and Illumination.

*To the Editors of Electrical World:*

Sirs:—Referring to an article entitled "Printing and Illumination," which appeared in your issue of July 29 on pages 259 and 260, I would like to remark that the author has apparently lost sight of the essentials of the theory of light-tinted symbols on a dark background.

First of all, I have no knowledge of any considerable discussion in the technical press during the past year on the subject of white letters on black backgrounds; the theory of light-tinted symbols on dark backgrounds, however, has received some attention. The writer may recall that in some articles he has written on this theory, he opposed the use of great contrasts in printing, such as white letters against dark or black backgrounds for reading purposes, claiming that such contrasts are not only unnecessary, but exceeding injurious to the eye, just as the present style of black on white is undesirable.

In the latter part of the second paragraph of the article referred to, the statement appears that "It is not the area that produces trouble, but the over-stimulation of any part of the area." I quite agree that it is not the area that produces trouble because the area might be anything; but that it is the character of the area that is to blame, and certainly printing as done on even white mat surfaces over-stimulates the eye.

I have advocated that until by proper process of evolution the light-tinted symbol theory can be successfully established, printing, especially in school books and periodicals requiring lengthy concentration of the eye and mind, be on an india-tinted matt surface or other tinted paper acceptable to the eye.

Aside from the theoretical side of this theory, one might also consider the purely practical aspect. Does it not seem to be the sensible thing to endeavor to "see" something that one looks at—which is the case of the light-tinted symbols on a dark background—rather than to see purely by contrast or indirectly, as is the case of our present method? Evidences of the appreciation of the light against dark theory may be readily noticed by referring to the use of such theory in a vast amount of sign work and display advertising. It is only a matter of time when it will be used for printing.

Finally, I would like to remark that just as data based on actual use are conspicuous by their absence in the discussion of the theory, such data are not in evidence in the article referred to, nor apparently used in arriving at the conclusions set forth. I would suggest that some experimentation be made before "findings" are offered.

New York. A. J. Marshall.

## Locating Vessels by Wireless Telegraphy.

*To the Editors of Electrical World:*

Sirs:—We have read the very interesting letters published in your issues of April 23, May 13 and 27, July 22 and Aug. 12 on the subject of the locating of vessels by wireless telegraphy. The letters indicate, however, that the use of our radiogoniometer for determining the position of a transmitting station is evidently not sufficiently well known, and there appears also to be some misconception as to the case of application of the method on board ship. For this reason we think that some information on the subject may prove of interest to the readers of the *Electrical World.*

For ship installations we employ only two equal and mutually perpendicular directive aerials, each one composed of two antennæ convergent at the upper ends and joined at the lower ends by a conductor, in circuit with which latter is the corresponding winding of the radiogoniometer. Each directive aerial makes an angle of 45 deg. with the longitudinal axis of the ship, and owing to this arrangement the antennæ do not form any incumbrance on the vessel, since they follow the line of the shrouds. In addition to the directive aerials, an ordinary vertical antenna is connected to the radiogoniometer.

The detector connected to the radiogoniometer can be of any known type—that is to say, a telephonic apparatus, a coherer, a reflecting galvanometer or even the Gáti barretter.

The direction of a transmitting station is obtained by determining the two limiting positions of the movable coil of the radiogoniometer where the reception vanishes and by bisecting the angle formed by these two positions. By taking several pairs of readings, an approximation of 1 deg. is readily obtained. The whole operation takes but a very brief time, as an ordinary wireless operator can make 10 pairs of observations in one minute, which number is more than sufficient to obtain the bearing of the transmitting station to the above approximation.

The chief advantage over all other methods, which depend mainly on quantitative measurements, consists in the fact that the direction is determined from the ordinary signals constituting messages, no special signals of long duration or at a low speed being necessary. By simultaneously employing the directive aerials and the vertical antenna one can determine both the direction and the sense in which the radiation arrives with respect to the position of the ship. The receiving arrangement usually employed makes use of telephonic reception; but if aural reception is disturbed by extraneous noises, the same results are obtainable if any other of the types of receiving apparatus mentioned above is employed.

One very important property of the radiogoniometric method of determining the direction of a transmitting station is that this determination is made instantly and independently of the course being followed by the vessel, while with all other methods the ship is obliged to make several attempts before it is possible to know if it is approaching or receding from the transmitting station. This property represents a saving of precious time and it is consequently evident that by the radiogoniometric method it is possible to bring, with the greatest rapidity and the least delay, the assistance demanded by a ship in distress. It is illusory to suppose that if a vessel in distress succeeds in signaling its position it is certain that the rescuing vessels will be able to find her easily. As a matter of fact, the ship, being generally at the mercy of the waves, the wind and the current, will have drifted from her original position while awaiting succor, and therefore the rescuing vessels, after

having reached the spot signaled them, will have to search, for hours perhaps, for the ship in distress. It is hence indispensable that the rescuing vessels should have at their command a system for locating the position of any ship which is sending signals; and the radiogoniometric method is the one which lends itself best to the attainment of this object.

Besides the use of the radiogoniometer for determining the direction of a ship in distress, we might call attention to the value of the same method for enabling one to avoid collisions in time of fog. For this purpose vessels fitted with wireless equipments have only to send signals from time to time during such atmospheric conditions, and then if such vessels are fitted with a radiogoniometer, each vessel can determine whether or not any of the others is on her course.

Another use of the radiogoniometer is in connection with making port, which in foggy weather is always dangerous. But if there is a wireless station in action in the neighborhood, a ship fitted with the radiogoniometer can, by taking the bearing of this station and regulating her movements thereby, make a landing with the greatest certainty, in the same manner as in clear weather, by taking the bearing of a light or other visible signal. The radiogoniometer in this way becomes a Hertzian "standard compass."

TURIN, ITALY. E. BELLINI AND A. TOSI.

# DIGEST OF CURRENT ELECTRICAL LITERATURE

*Abstracts of the important articles appearing in the electrical periodical press of the world*

## Generators, Motors and Transformers.

*Temperature Within Magnet Coils.*—K. HUMBURG.—The maximum temperature which occurs in the interior of a magnet coil cannot be directly measured. However, since this maximum temperature is of importance for determining the permissible current, it is advisable to calculate the maximum temperature within the coil from the mean temperature, which can be determined by resistance measurements and from the temperature on the surface. The author gives the mathematical theory of the distribution of the temperature in the interior of magnet coils of rectangular cross-section.—*Elek. und Masch.* (Vienna), July 18 and 25.

*Single-Phase Commutator Motor.*—C. NOOME AND K. H. HAGA.—An account of an experimental investigation of the iron losses in the rotor of a single-phase commutator motor. The authors describe a test in which they find that the rotor iron losses are a function of the speed, and that, beginning with a certain low speed, the iron losses are about proportional to the speed.—*Elek. Zeit.*, Aug. 19.

*Single-Phase Motors.*—F. EICHBERG.—An illustrated translation of his German paper, recently noticed in the Digest, on different types of alternating-current commutator motors. The author investigates the influence of the frequency on the generators, transformers, transmission line, and more especially on single-phase commutator motors.—Lond. *Electrician*, Aug. 20.

*Leakage Reactance.*—J. REZELMAN.—The first part of an illustrated mathematical article in which the author deals with the leakage reactance of the stator windings of alternating-current machines, the rotors being removed. The leakage flux is separated into its component parts, for several machines, by means of experiments; the effect of the type of winding upon the overhang leakage, and the relationship between the reactance of the windings in three-phase and in single-phase working are observed. Formulas are given by means of which the stator reactance can be calculated.—Lond. *Electrician*, Aug. 20.

*Losses in Three-Phase Motors.*—A. LANG.—In three-phase motors the measured iron losses are sometimes found much greater than the calculated losses, although in other cases the calculated and measured losses agree closely. The disagreement has been investigated by Bragstadt and Franckel as the "additional losses" in three-phase motors. The present author has applied a theory of his own to various motors and finds that it agrees very well with the experiments.—*Elek. und Masch.* (Vienna), July 25.

## Lamps and Lighting.

*Metallic-Filament Lamps.*—A. LIBESNY.—The first part of a paper read before the German Association of Electrical Engineers concerning the question of the best conditions (especially watts per candle) under which metallic-filament lamps may be operated. He states that even incandescent-lamp experts make mistakes in this respect. He describes a graphical method showing the relation between the different factors which determine the best conditions of operation. In this graphical method he gives the price of the lamp in units of energy. For instance, if a lamp costs 75 cents and 1000 watt-hours cost 7½ cents, then the cost of the lamp is stated to be 10,000 watt-hours. His graphical method is first based on the consideration of "ideal" lamps, which maintain their efficiency constant throughout their life. He finally gives life tests of osram lamps operated at different specific consumptions, namely, 1.1 watt, 1.0 watt, 0.9 watt, 0.8 watt, 0.7 watt, 0.6 watt, 0.5 watt per hefner candle. (Fig. 1.) The abscissas are hours, the ordinates are per cents of the original candle-power. The paper is to be concluded.—*Elek. Zeit.*, Aug. 19.

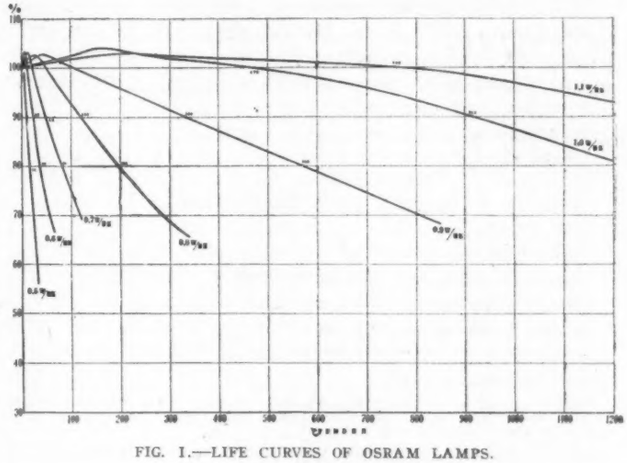


FIG. 1.—LIFE CURVES OF OSRAM LAMPS.

*Incandescent Lamps.*—A. C. JOLLEY.—The conclusion of his illustrated paper on modern incandescent electric lamps. In the present instalment the author deals with the temperature of the filament and calculates the temperature on the basis of the formulas of Stefan, Petavel, Rasch and Nernst. The results are given in diagrams and summed up in the following table:

| Type of filament | Watts per cp. | Temperatures deg. C. Stefan. | Petavel. | Rasch. | Nernst. |
|---|---|---|---|---|---|
| Carbon | 3.5 | 1,557 | 1,607 | 1,647 | 1,657 |
| Gem (graphitized carbon) | 3.13 | 1,632 | 1,667 | 1,687 | 1,717 |
| Tantalum | 1.645 | 1,427 | 1,707 | 1,717 | 1,737 |
| Osram (tungsten) | 1.25 | 1,517 | 1,827 | 1,777 | 1,807 |

He points out that the figures given in columns 5 and 6 are in practical agreement with the empirical law of Lummer and Kurlbaum, namely, that the light emitted by a glowing body increases as the twelfth power of the absolute temperature in the neighborhood of 1900 deg. C. absolute. He finally thinks that a careful study of the form of the energy curves of incandescent bodies is the direction in which one must look for further advances in economical light production; for, apart from the difficulty in finding suitable refractory materials which are permanent at very high temperatures, one is always confronted by the facts that, firstly, at the highest temperatures, by pure temperature radiation, more than 50 per cent efficiency can never be attained, and as temperatures are pushed up the increase in economy must be always offset by the serious sur-

face disintegration, and consequent short life which always accompanies it.—Lond. *Electrician*, Aug. 20.

*Photometry of Differently Colored Lights.*—H. Morris-Airey.—A letter on the reason why the flicker photometer gives varying results when the sources of light to be compared are of different tint. Since the eye includes two types of sensitive elements—the rods and cones—Wild has suggested that as the speed of the flicker head is increased the cones are unable to follow the changes, so that there is rod vision only, and since for color sensation one depends on the cones, the comparison of the differently colored lights will lead to inaccuracies. However, it has been shown that the cones respond much more quickly to stimulation than the rods. The present author thinks that the real explanation is to be found in the excitation curves of the retina for differently colored lights. If two lights are compared by means of the flicker photometer, then at one speed practically the red components are being compared, while at another speed it may be the violet components which are preponderating in the stimulus of the retina. Clearly this can only lead to correct results for the comparative intensities, when the two lights have their component colors mixed in exactly the same proportions—that is, when the two lights are identical in tint.—Lond. *Electrician*, Aug. 20.

### Generation, Transmission and Distribution.

*Influence of Wave-Forms on the Efficiency of Energy Transmission.*—C. F. Holmboe.—The author describes a case in which differences in the wave-form of two electrically connected synchronous machines resulted in considerable losses. From a large central station energy was transmitted by three-phase currents at 5000 volts to substations. The central station was a direct-current station, which was to be changed over to three-phase, and during the time of a change a motor-generator transforming from direct current to three-phase currents was installed—indicated by *I* in Fig. 2. The three-phase generator

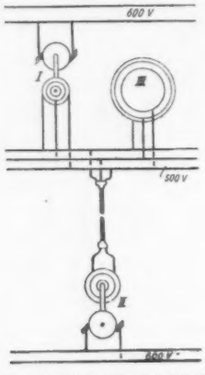



FIG. 2.—DIAGRAM OF CONNECTIONS.

of this set produced three-phase currents at 5000 volts which were transmitted to a three-phase, direct-current motor generator *II* in the substation. Both sets *I* and *II* were exactly identical in construction and electrical design, since after the change of the central station was completed it was intended to install set *I* also in the substation. The rating of both *I* and *II* was 100 kw. The efficiency of the transformation of direct current to three-phase currents in set *I* and of the transformation from three-phase currents to direct current in set *II* was found to be 84 per cent. At normal load—200 kw—and with correct magnetizing current, the power factor was unity. After this plant had been in use for one and a half years the new three-phase station could be started and the set *I* became superfluous in the central station. The substation was now connected to the steam-driven three-phase generator *III* in the central station. It was then found that the efficiency of transformation from three-phase to direct current of set *II* had been reduced to 79 per cent. Moreover, it was no longer possible to get a unity power factor. It was found that this was due to the difference in wave-forms of the three-phase machines *II* and *III*. The former had three and the latter two slots per phase and pole. The yearly losses of the company corresponded to the interest on a capital of some $10,000.—*Elek. und Masch.* (Vienna), July 11.

*Gas Producers.*—O. Nagel.—An article on the evolution of the gas producer, with brief illustrated descriptions of a great many different types of producers.—*Electrochem. and Met. Industry*, September.

*Water-Power in Winter.*—W. von Winkler.—An article giving practical notes on the operation of a water-power station in winter.—*Elek. und Masch.* (Vienna), Aug. 15.

### Traction.

*Hungaria.*—Statistical data on the electric railways in Hungaria at the end of 1908. There were four electric interurban roads, with a total length of 44 km, of which 8 km are double-track, and 14 electric street railways, with a total length of 217 km, of which 142 km are double-track.—*Elek. und Masch.* (Vienna), July 18.

*Single-Phase Railway.*—Henry.—An illustrated description of the single-phase railway from Rotterdam to La Haye and Schveningen. Each of the cars has two 180-hp motors. These are Siemens series motors with commutator poles and compensated winding.—*L'Industrie Elec.*, Aug. 10.

*Rail Corrugation.*—Peterson.—An abstract of a report on an exhaustive study of the causes for rail corrugation. The author attributes corrugation largely to the formation of incipient waves in the rails during the process of rolling, and discusses the whole process of rolling girder rails. He makes some recommendations as to changes in methods by which he believes corrugations can be prevented.—*Elec. Rail. Jour.*, Aug. 28.

*Cable Roads.*—E. E. Seefehlner.—A long mathematical article on various points in the theory and practice of cable roads, with illustrated descriptions of two new mountain cable roads in Tyrol and Hungaria.—*Elek. und Masch.* (Vienna), Aug. 1 and 8.

### Installations, Systems and Appliances.

*Central-Station Statistics of Austria.*—The first complete statistics of the central stations of Austria. Only those stations are mentioned which supply energy for public purposes. Traction stations are excluded and also all isolated stations which do not supply energy to other customers. There are now in Austria 571 central stations. For 561 of the same, with a total rating of 285,353 kw, the system used is known. Direct current with storage batteries is used in 229 stations, direct current without storage batteries in 138 stations, single-phase current in 14 stations, two-phase currents in 5 stations, three-phase currents in 154 stations, and combined alternating-current and direct-current systems in 21 stations. In the alternating-current stations the frequency is 50 cycles in 112 stations, 42 cycles in 36 stations, while other frequencies are used in 10 stations. Cable networks are used in 14 stations, overhead wires in 232 stations, both cables and overhead wires in 115 stations, while no information is available about 209 stations. In direct-current stations the three-wire system is used in 190 stations, the five-wire system in 2 stations, and the two-wire system in 165 stations. One hundred and eleven stations are operated by steam, 275 by water, 85 by steam and water, 21 by gas, 17 by oil engines, 2 by gasoline engines, 10 by steam and gas engines, 30 by water and gas engines, and 6 by steam, water and electric motors. Ten stations have a rating above 5000 kw, 32 stations a rating between 1000 kw and 5000 kw. The tariff system used is classified in the following table:

| Tariff system. | Number of stations—For lighting. | | For other services. | |
|---|---|---|---|---|
| Meters without discount | 140 | 219 | 118 | 198 |
| Meters with discount | 79 | | 80 | |
| Flat rate | 164 | | 98 | |
| Combined rate: | | | | |
| Tariff unknown | 102 | | 78 | |
| Flat rate and meter | 81 | | 191 | |
| Double-meter tariff | 6 | | 6 | |
| Total number | 572 | | 571 | |

Some of the newer works are using metallic-filament lamps. *Elek. und Masch.* (Vienna), Aug. 8.

*Circuit-Breaker.*—A note on a recent British patent (20,268,

1908; Aug. 12, 1909) of the Siemens Brothers Dynamo Works for a switch for automatically breaking the connection between two separately fed sections of a traction conductor as soon as a fault develops in either, and for automatically reconnecting the two sections when the fault is removed. When the circuit-breaker operates, it simultaneously closes a resetting switch, which causes the breaker to be closed again when both sections are at the normal pressure.—Lond. *Elec. Eng'ing*, Aug. 19.

**Wires, Wiring and Conduits.**

*Cable Laying.*—C. A. SMITH.—An illustrated description of two appliances for cable laying, useful in out-of-the-way places. They are a "cable-drum carriage" and a special "duct reel" for threading underground cable tubes with draw wires.—Lond. *Elec. Review*, Aug. 20.

**Electrophysics and Magnetism.**

*Mechanical Equivalent of Heat.*—H. T. BURNS.—A paper read before the (British) Royal Society on the absolute value of the mechanical equivalent of heat in terms of the international electrical units. In 1902 the author and H. L. Callendar determined the capacity for heat of water at different temperatures between 0 deg. C. and 100 deg. C. by means of the continuous method of calorimetry. A steady electric current was used to heat a steady flow of water through a fine-bore tube, bringing about steady temperature conditions in the calorimeter. The energy given in joules was expressed in terms of the international electric units, and was consequently dependent on the values of the standards used in the measurements. They adopted the legal value of the Clark cell. Since that value of the cell has been shown in the meanwhile to be slightly erroneous, the author has calculated the former results on the basis of the new value for the Clark cell. The mean value of the thermal capacity of water at different temperatures between 5 deg. C. and 95 deg. C. in joules per calorie is now 4.1835, compared with 4.1888 originally stated. The author compares his result with those of other experimenters. He finds an excellent agreement, which shows that at the present time the knowledge of the electrical units must be not far from the truth, both as regards the voltage of the Clark cell and the ohm.—Lond. *Electrician*, Aug. 20.

*Spectroscopic Measurements.*—An account of an investigation carried out in the German Reichsanstalt in which spectrum

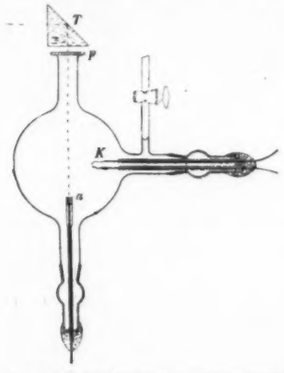



FIG. 3.—SPECTROSCOPIC MEASUREMENTS.

lines of considerable intensity and sharpness were produced by means of an arc in vacuo. In the vacuum tube with incandescent Wehnelt cathode electric currents of considerable strength can be used so that the anode becomes so hot that it melts and evaporates. The arrangement is shown in Fig. 3. The anode *a* ends in a porcelain tube which contains the material to be evaporated. The material is in electric connection with the metallic wire of the anode. *K* is the Wehnelt cathode brought to incandescence by means of current from an auxiliary battery. The light emitted from the anode *a* vertically upward passes through a horizontal plate *p* and is deflected by means of the prism *T* so as to direct it in horizontal direction into the spectroscope.—*Elek. Zeit.*, Aug. 19.

*Conductivity and Tension of Wires.*—J. SAHULKA.—An account of some experiments which were made to determine whether the tension in stretched iron or aluminum wires has any effect on their conductivity. He found that the conductiyity does not change as long as the tension does not go beyond the elastic limit.—*Elek. und Masch.* (Vienna), Aug. 15.

**Electrochemistry and Batteries.**

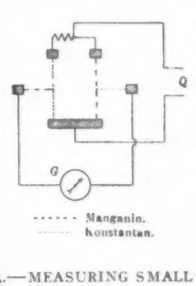
*Electrode Losses.*—C. A. HANSEN.—An account of an experimental investigation of the consumption of electrodes by oxidation, with special reference to graphite and carbon electrodes. The importance of having mechanically strong electrodes is pointed out in view of the great troubles due to breakage. The author thinks that there is nothing in the nature of amorphous carbon which would prevent making large and perfectly strong electrodes from it.—*Electrochem. and Met. Industry*, September.

*Electrode Losses.*—C. HERING.—An article on the heat losses through electrodes. For any material it is possible to predetermine theoretically the best dimensions of an electrode in which the heat losses through the electrodes become a minimum. These best dimensions depend on the current, the temperature and the specific properties of the material. It is wrong to select the dimension of electrodes on the basis of current density.—*Electrochem. and Met. Industry*, September.

**Units, Measurements and Instruments.**

*Measuring Small Alternating Currents.*—A description of a new arrangement used by the Reichsanstalt for the measuring of small alternating currents with thermo-couples. It permits the measurement of small voltages with small energy consumption. The arrangement is shown in Fig. 4, in which the lines consisting of dashes represent manganin wires and the lines consisting of dots represent constantan wires. The current coming from the source *Q* of direct or alternating current passes through the manganin and the constantan wires in parallel, both being 20 microns in thickness. A constantan wire is connected to the center of the manganin wire and one terminal of the galvanometer *G*. A manganin wire is connected to the center of the constantan wire and to the other terminal of the galvanometer. The connections are made by soldering with silver. The thermo e.m.fs. of the two joints are added together and there are no Peltier effects. A suitable resistance permits distribution of the current between the two wires in such a way that the current in the galvanometer circuit is zero.—*Elek. Zeit.*, Aug. 19.

*Speed Regulator.*—In investigations by the German Reichsanstalt of an automatic speed regulator for motors is em-



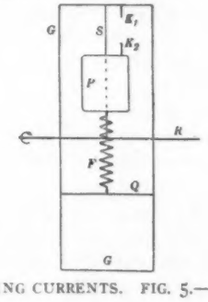




FIG. 4.—MEASURING SMALL ALTERNATING CURRENTS. FIG. 5.—SPEED REGULATOR.

ployed the arrangement of which is shown in Fig. 5. *R* is the axle of rotation of the shunt-wound motor. The weight *P* is movable along a steel wire *S*. This wire is stretched between the axle *R* and the frame *G*. *Q* is a cross-connection which can be placed at different points of the frame *G*. The spiral spring *F* is stretched between the weight *P* and the cross-connection *Q*. At a certain speed the weight begins to move away from the axle until the points $K_1$ and $K_2$ come in contact, whereby a resistor in series with the magnet winding of the motor is short-circuited. The speed of the motor is thereby reduced until the contacts $K_1$ and $K_2$ are separated again. By adjusting the position of the cross-connection *Q* of the frame *G* it is possible to adjust the speed for which the arrangement becomes operative.—*Elek. Zeit.*, Aug. 19.

*String Electrometer.*—T. H. LABY.—A paper read before the

Cambridge Philosophical Society. The author gives an account of experiments in which he substituted a stretched silvered-quartz fiber for the gold leaf of an electroscope. The string electrometer used in these experiments consisted of two vertical insulated plates 15 cm long by 0.8 cm thick, with their edges parallel and at an adjustable distance apart. These plates were connected to the terminals of a battery, the middle of which was earthed. The silvered-quartz fiber was stretched parallel to and equidistant from the two plates by the lateral movement of its points of support, while its tension, which must be kept very constant, was controlled by a screw. The terminals of the middle cell of the battery were connected to a potentiometer, the middle of which was earthed, so that the potential of the fiber could be varied from —1 volt to +1 volt by steps of 0.02 volt. As the fiber was not highly insulated, tests could not be made with it isolated, so that the results given later were got with the potential of the fiber maintained. The motion of the middle of the fiber was observed by means of a microscope. This string electrometer is not only quite sensitive, but it also appears to be useful for automatically recording rapid changes of voltages. In its use for the study of continuous phenomena the movement of the fiber is recorded photographically.—Lond. *Electrician*, Aug. 20.

*Ohmmeter.*—E. Siedek.—A description of a new ohmmeter which is based on the fact that if the current through a resistor is 1 amp, or 10 amp or 100 amp, a voltmeter applied to the terminals of the resistor gives directly the ohms or the ohm multiplied by 10 or 100, etc. The principle is shown in Fig. 6, where $x$ is the resistor whose resistance is to be meas-

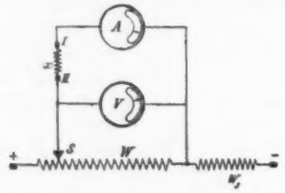



FIG. 6.—DIAGRAM OF OHMMETER CONNECTIONS.

ured and $w_s$ is a series resistor whose resistance is large enough to permit short-circuiting *I* and *II* without hurting the instruments. *A* is an ammeter and *V* a voltmeter. The sliding contact *s* is moved along the resistor *W* until the ammeter *A* shows exactly 1 amp. Then the volts read on the voltmeter give directly the resistance of $x$ in ohms. The resistance of the ammeter *A* (which has been determined previously) must, of course, be subtracted. There is no necessity to calibrate the resistance of $w_s$ and $w$. To improve the accuracy of determination, two sliding contacts may be used. A further modification is also described as is also an arrangement which can be employed as the universal apparatus which permits one to read directly the voltage, current and resistance.—*Elek. und Masch.* (Vienna), July 18.

*Thermo-Couples.*—E. Alkenkirch.—A mathematical paper in which the author calculates, on a theoretical basis, the maximum possible efficiency of a thermo-couple.—*Phys. Zeit.*, Aug. 15.

*Reichsanstalt.*—A review of the work of the Reichsanstalt in the year 1908. The results of some special investigations are noticed elsewhere in the Digest.—*Elek. Zeit.*, Aug. 19.

### Telegraphy, Telephony and Signals.

*Telegraph Statistics.*—H. von Hellrigl.—Statistical tables on telegraphy in the different countries of the world in 1907. The tables refer to traffic, extension of networks, telegraph stations, apparatus, financial results, etc.—*Elek. und Masch.* (Vienna), Aug. 1.

### Miscellaneous.

*Electricity in the Bible.*—E. Stadelmann.—An article pointing out that it is highly probable that the ancients had a knowledge of electricity, which was restricted, however, to the priests. The priests had a knowledge of many physical phenomena by means of which they could exhibit their superiority over the common people. It has been established that the priests in temples and some distance from each other communicated by a kind of light telegraphy, using almost exactly the system now employed in war of sending light rays by means of mirrors to certain points. The author further claims that the old Israelites knew the lightning rods, as the temple was protected by lightning rods. References are made to various descriptions in the Bible. It is also claimed that the Ark of the Covenant was a large Leyden jar. This was charged by means of rods on the temple with atmospheric electricity. Under the climatic conditions of the country, the author thinks that quite strong effects could be obtained. If anybody came near the Ark of the Covenant and touched its outside he would get an electric shock and would perhaps be killed. The priests protected themselves with clothes of metallic foil (gold foil), which is quite similar to the metallic protecting suit now used by Professor Artemieff in his experiments with high-voltage electricity. It is probable that the altar was also a large Leyden jar. Numerous references are made to the Bible. The author thinks that Moses got his knowledge of electricity from the Egyptians. —*Elek. Anz.*, July 25.

*Heat Conductivity of Refractory Materials.*—S. Wologdine and A. L. Queneau.—The first part of a long account of an experimental investigation of the heat conductivity, porosity and gas permeability of refractory materials. The chief figures of the heat conductivities of various refractory materials in the temperature range up to about 1000 deg. C. are given in the following table:

| Material. | Conductivity. Gr. cal. per sec. per sq. cm. per cm. per 1°C diff. | Kg. cal. per hr. per sq. cm. per cm. per 1°C diff. | Relative conductivity. |
|---|---|---|---|
| Graphite brick | .025 | 9.0 | 100.0 |
| Carborundum brick | .0231 | 8.32 | 92.4 |
| Magnesia brick | .0071 | 2.54 | 28.4 |
| Chromite brick | .0057 | 2.05 | 22.8 |
| Fire brick | .0042 | 1.50 | 16.7 |
| Checker brick | .0039 | 1.42 | 15.8 |
| Gas retort brick | .0038 | 1.36 | 15.2 |
| Building brick | .0035 | 1.26 | 14.0 |
| Bauxite brick | .0033 | 1.19 | 13.2 |
| Glass pot | .0027 | .96 | 12.4 |
| Terra cotta | .0023 | .84 | 9.3 |
| Silica brick | .0020 | .71 | 7.8 |
| Kieselguhr brick | .0018 | .64 | 7.1 |

The figures selected are representative of the grade of refractory materials that are available for every-day furnace work. —*Electrochem. and Met. Industry*, September.

*Exposition at Nancy.*—J. Izart.—An illustrated description of various exhibits of French companies at the exposition at Nancy.—*L'Industrie Elec.*, Aug. 10.

*Atmospheric Electricity and Air Ships.*—L. Zehnder.—The author shows that discharges of atmospheric electricity may become dangerous for balloons if considerable portions of the balloon itself or near it are good conductors of electricity. The following remedies are recommended for the Zeppelin airship: first, the aluminum frame may be replaced by a wooden frame; second, the aluminum frame may be provided with special lightning arresters, and, third, the whole cover of the balloon could be made of very thin metal. The last recommendation appears to be favored.—*Elek. Zeit.*, Aug. 12.

*College.*—An illustrated description of the electric equipment of the new building of the Merchant Venturers' Technical College, in Bristol, describing the lighting and power systems, the equipment of telephones and time distribution by electric clocks; also the equipment of the electrical engineer's laboratory, the engine and testing-room and the electric supply for experimental purposes.—Lond. *Electrician*, July 30 and Aug. 6.

*Australian Manufacturing Plant.*—J. H. Davies.—An illustrated description of the works of the S. Weymouth Proprietary Company, Limited, of Melbourne. Their production includes electric generators, transformers and switchgear.—Lond. *Electrical Review*, July 20.

*Pump.*—An illustrated description of the Gaede high-vacuum mercury pump.—Lond. *Electrician*, Aug. 13.

*Ferro-Tungsten.*—J. Escard.—The first part of a serial on the preparation of ferro-tungsten.—*La Lumière Elec.*, July 10.

*Electric Heaters.*—A description of electric heaters in which the radiating tubes are made of fused quartz and contain pure nickel wire spiral resistors. The use of the quartz tube renders a high temperature possible.—Lond. *Elec. Eng'ing*, July 8.

## BOOK REVIEWS.

LA MACHINE Á INFLUENCE. By V. Schaffers. Paris: Gauthier-Villars. 506 pages, 197 ills. Price, 10 francs.

This is a treatise on the influence machine in which the evolution of this form of electrostatic generator is given very fully. It differs from the smaller work of J. Gray, to which frequent reference is made, in being practical as well as descriptive. Beginning with Bennet's doubler, he describes in turn all the machines of importance, their defects as well as their good points; their theory as well as their history. Considerable space is devoted to the best known forms, such as the Holtz, the Voss, the Wimshurst and the Bonetti. The conditions for efficiency and auto-excitation are carefully studied, as well as the causes which bring about reversal of polarity. He takes care to say that a Wimshurst machine constructed as usual with 16 or more sectors and with brushes making good contact is practically independent of hygrometric conditions and is irreversible in polarity. The author has given considerable attention to the function of the characteristic parts of the leading types of machines and the play of electric forces in them, as is evident from the great number of experimental investigations made by him for the purpose of clearing up certain doubtful matters regarding output and theory.

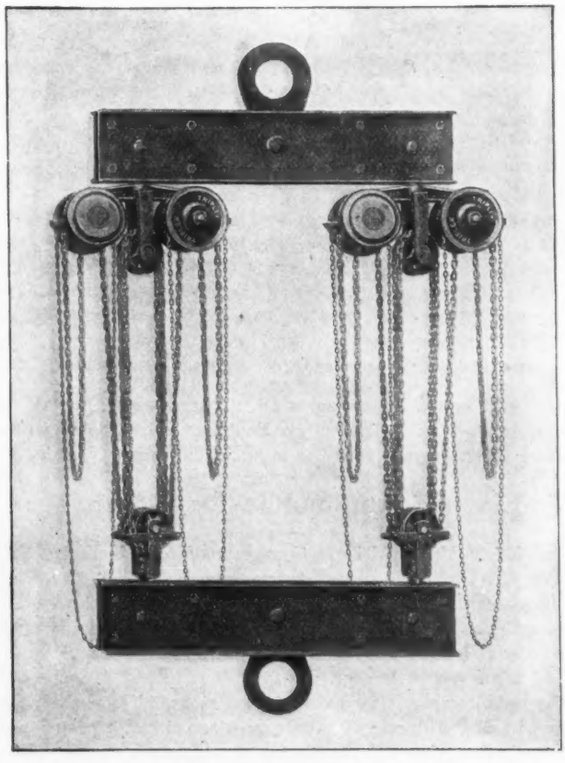
LA DEFINITION ET LA MESURE INDUSTRIELLES DE L'ACCELERATION DES TRAINS. By C. O. Mailloux. Paris: Gauthier-Villars. 12 pages.

This reprint from *La Revue Electrique* of Nov. 30, 1908, gives the complete text of the original paper presented, in French, by the author, before Section V of the International Electrical Congress, at Marseilles, in September, 1908. The reprint also contains the discussion of the paper by M. Legouëz, managing director of the Paris "Metropolitan" (subway system), who was one of the vice-presidents of Section V. It also includes an editorial by M. Blondin, the well-known electrical writer and authority, for many years the editor of *L'Eclairage Electrique* and now editor of *La Revue Electrique*. A condensed and paraphrased English translation of the paper was published in the *Electric Railway Journal* of Feb. 13, 1909 (Vol. XXXIII, pp. 277-279), with an editorial comment (p. 270).

# NEW APPARATUS AND APPLIANCES

## Forty-Ton Triplex Chain Block.

When the ordinary mechanical man thinks of a chain block it is usually one of the smaller capacities, ranging from the one-eighth differential to the one-ton, two-ton, or maybe five-ton blocks of higher efficiency. Even engineers, who should be



FORTY-TON TRIPLEX CHAIN BLOCK.

hoisting experts, but who are not directly in touch with the latest practice in the use of hand hoists, are apt to think of chain blocks above 10 tons as something unusual, to be tried only when no other means of handling heavy loads can possibly be made available. In point of fact, the larger sizes of chain blocks are just as available under certain circumstances as the differential is for light loads. The Yale & Towne Manufacturing Company has regularly for years made its triplex chain blocks up to 20 tons capacity, and the 40-ton triplex illustrated herewith has recently been developed to meet the demands of engineers for a dependable hand hoist to handle very heavy loads where the installation of an electric crane or powerful steam hoist, because of time or cost, would be out of the question.

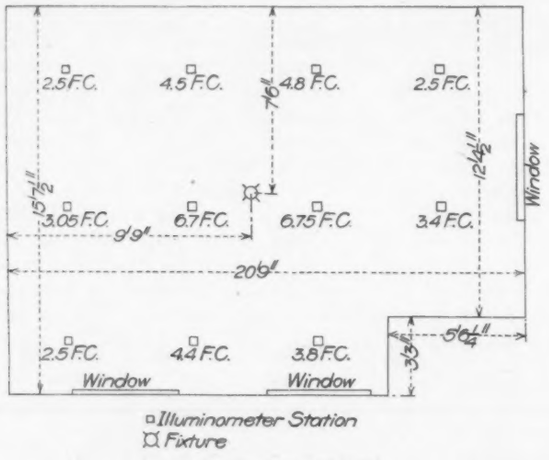
The 40-ton triplex is composed of two 20-ton units with equalizing bars at the top and bottom. This provides for single-point suspension and for a single point for attachment of load. The equalizing bars are made of two channels placed back to back with separators. Provision is made for the swiveling of each unit at top and bottom. The clevises or points of attachment enable the user easily to put the hoist in place wherever used, and also afford a convenient point for the attachment of the load.

It will find its fields of usefulness in manufacturing plants, and generally for loading and unloading. It may be installed over railroad tracks on a properly guyed temporary or permanent trestle. Lateral motion may be secured by one or more trolleys running on a large I-beam. It is available for handling heavy weights, etc., where headroom, cost, infrequency of lift or other conditions do not permit the use of power cranes of sufficient capacity. The hand chains are arranged to permit two, four or eight men to work effectively. Where the load is larger than 40 tons, it is generally of sufficient size to permit two of these hoists to be worked together, giving a capacity of 80 tons.

## Test of Indirect Lighting of a Small Office.

A measurement was recently made of the illumination obtained in a small office-room in Philadelphia employing indirect lighting using the system in which all the light is first directed to the ceiling by a reflector placed under the lamp. The illumination of the room is accomplished by reflection from a light-colored ceiling. The test was made with a Sharp-Miller photometer under the direction of Mr. R. B. Ely. A plan of the office-room in which these tests were made is shown on page 628. This office was 9 ft. 9½ in. high with light buff ceiling and walls. The floor had a dark green carpet and the window shades were dark brown. The woodwork was golden oak. Four 100-watt frosted-bowl tungsten lamps were used, under each of which was placed a No. E-100 "I-Comfort" reflector,

made by the National X-Ray Reflector Company, of Chicago. The fixture was located in the center of the room, as indicated below. The lamps were 27½ in. from the ceiling. Lamps and reflectors were clean. Readings to obtain the illumination in foot-candles were taken at 11 stations located as




PLAN OF ROOM TESTED.

indicated by the squares above. The plane of illumination in which the test was made was 34 in. above the floor. The illumination in foot-candles obtained at each test station is marked at each station. The room was 308 sq. ft. in area and 400 watts were used, the watts per square foot thus being 1.3. The average illumination was 3.99 foot-candles, the maximum being 6.75 and the minimum 2.4. The watts per lumen (watts per square foot per foot-candle) were 0.325 and the lumens per watt 3.07. In connection with this test Mr. Ely notes that the installation was made by the use of adaptable units on existing fixtures, and that the efficiency of the installation could be increased by shortening the fixture so as to bring the lamp to within 18 in. of the ceiling.

## A Folding Chandelier.

Mr. L. V. Hornbeck, New York Life Building, Minneapolis, Minn., is the designer and inventor of a folding chandelier which is shown in the accompanying engravings. One of these chandeliers complete and ready for use is shown in Fig. 1;

FIG. 1.—COMPLETE CHANDELIER.

as folded up in shape for packing and shipment in Fig. 3; and disassembled in Fig. 2. Fig. 4 shows the details of construction. Upon removing the ornamental knob at the bottom, the lower canopy is removed and the arms can be inserted or taken out. The arms are held in place by the set screws and by the upper part of the canopy and also by the head or center casting. The removal of the lower half of the canopy does not allow the chandelier to fall to pieces, but simply makes it accessible for the insertion or removal of the arms and wiring. This fixture is wired, connected and assembled in the factory, and when

FIGS. 2 AND 3.—FOLDING CHANDELIER.

ready to pack the set screw is loosened and the arms are folded alongside the stem, as in Fig. 3. The fixture can be

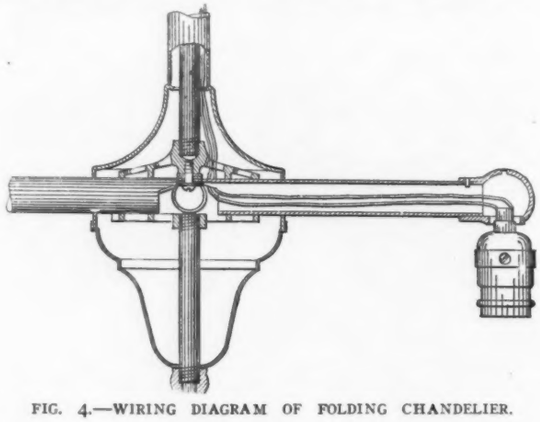


FIG. 4.—WIRING DIAGRAM OF FOLDING CHANDELIER.

packed in a box 6 in. x 6 in. x 18 in., or whatever length the fixture happens to be. It is claimed that it can be unpacked and the arms inserted ready to hang in five minutes' time.

## Electric Automobile for Royalty.

The Baker Motor Vehicle Company, of Cleveland, has just completed a luxurious electric automobile for the King of Siam.

The chassis and body of the automobile are standard. The body and running gear are finished in ivory. The top is made of a special leather enameled in white. The dash and fender are of white patent leather.

The upholstering is in a delicate green broadcloth, the royal color of Siam, with silver-gray Persian broad lace tapestry, puff rolls and silver-gray silk cord. All metal parts are silver plated and equipped with special silver electric lamps and meter case. The lever handles are of pearl. The hood has beveled-glass windows at each side and in the rear. The side panels and front of the hood are emblazoned with the royal crest of the King of Siam. In order that Clevelanders might see and appreciate the richness and elegance of the car, it was put on exhibition at the corner of Euclid and Huron Road from Aug. 9 to Aug. 14.

## Magnetic Fault-Finder for Lead-Covered Cables.

An apparatus has recently been put on the market by Middleton Brothers, Monadnock Block, Chicago, of considerable interest to electric-light and power companies using underground or aerial, lead-covered cables. It is a device for locating faults in cables magnetically, from the induction of a sharply irregular alternating current sent over the faulty wire and returning over the lead sheath or an adjacent wire.

The magnetic fault-finder for power cables consists of an electrolytic or mechanical interrupter, with a four-winding

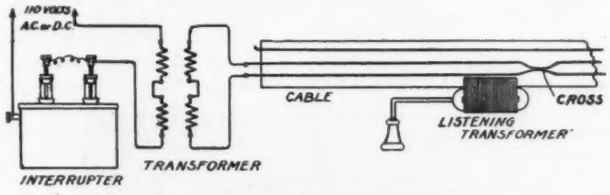
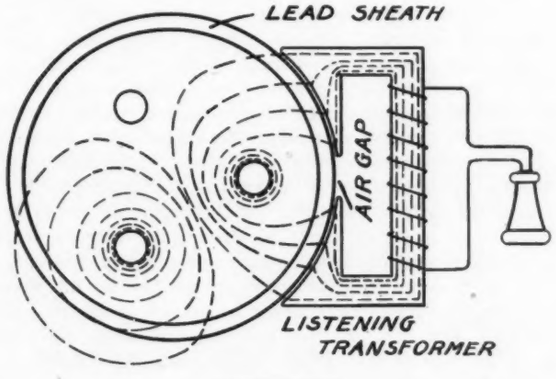



FIG. 1.—DIAGRAM OF CONNECTIONS.

transformer. These are stationed at the cable terminal and connected to 110-volt alternating or direct-current mains. With a listening transformer in series, a man with a receiver at each ear investigates the sound of the current in the faulty wire at various points along the cable (see Fig. 1), and the fault will be found where the sound ceases. The fault can often be located within 2 in. or 3 in. As the method does not depend upon the resistance of the conductor, the cases that do not lend themselves to a bridge measurement can thus be located inductively.

The success of the method depends on a sharp alternating wave, a sine wave not being sufficiently noisy in a receiver. Again, the testing current must be radically different from any regular wave such as 25 cycle or 60 cycle. An electroytic interrupter lends itself well to the production of a current that is easily distinguished. If two interrupters of the Caldwell type are connected in multiple with a large aperture in one, and a small one in the other, the action of the large hole predominates until the electrolyte rises to a certain height, when the smaller tube assumes control while the electrolyte runs out. The result is an intermittently interchanged high- and low-frequency current which is very distinctive.

The important thing in the design of the transformer is that it will receive all possible influence from the faulty wire without gathering in the neutralizing lines of force from the return circuit. In case of a ground, this is simple enough, but in




CONSTRUCTION.

FIG. 2.—DIAGRAM SHOWING PRINCIPLE OF TRANSFORMER

case of the current wholly returning over an adjacent conductor the distinction becomes important. Fig. 2 shows the principle on which the laminated transformer core is made. The broken lines indicate the influence on the receiver. The reluctance of the air-gap is much greater than the path through the coil, even if the tips of the core are much closer together than shown.

Should the lay of the cable become 6 ft., and it is impossible to get at the cable except on one side, there will be quiet nodes every 3 ft. and first one phase will predominate, then the other phase.

It is not necessary to remove the tiling from high-tension cables in the manholes, as the ear picks up the sound distinctly 8 in. or more away. When all the current returns on the sheath, the centers of the circles of force are at different distances from the air-gap of the listening transformer, and therefore one predominates over the other.

Breakdowns are often so severe that the conductors are

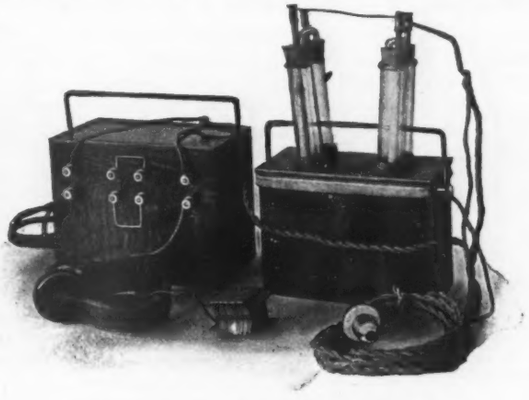


FIG. 3.—CABLE FAULT-FINDER COMPLETE.

burned completely in two, or are badly damaged. A loop test then becomes impossible, or very uncertain. If one of the conductors can be broken down to ground, or crossed with one of the other phases sufficiently to get a few amperes through the fault with a safe voltage, the fault can be quickly located with the listening transformer. This transformer may be called a magnetic trap that is focused, in a way, on the faulty wire. The transformer is in series with the double receiver and is wound accordingly.

A 10-ft. flexible copper cord allows the listener to remain outside the manhole while the transformer is applied to the cable. The loudness of noise in the receiver depends upon the strength of current in the faulty wire; therefore, the interrupter transformer at the cable terminal is made with two windings on each primary and secondary. Thus a large current may be sent out on large and small conductors, on long and short cables.

The electrolytic interrupter is in duplicate and the cable can be instantly switched, so that the testing current will be continuous. A mechanical interrupter may be substituted for the electrolytic one and telegraph signals sent out over the cable. This fault-finder, which has been successfully employed in electric-light cable testing in Chicago for several months, may also be employed for locating faults on telephone, telegraph and signal cables.

## New Factory of Moore Electrical Company.

The Moore Electrical Company has recently purchased a factory at 167-171 Malvern Street, Newark, N. J., consisting of a brick building 42 ft. x 100 ft., of mill construction and three stories in height, with 16,000 sq. ft. of floor space, and cement basement. The building is well lighted on all sides and has skylights over the third floor. The plant, which is equipped with boiler-room, engine, and freight elevator, is modern throughout. This space will provide proper manufacturing facilities for the constantly growing business of the Moore lamp. The first floor is used for the glass department and shipping. The machine shop and offices are located on the second floor, and the engineering department is on the third floor.

## Reid Lightning Arrester.

A company has been formed in Colorado Springs., Col., with C. T. Fertig as president; O. E. Collins, vice-president; A. Elliott Hart, treasurer; C. B. Garnett, secretary, and Andrew Reid, general manager, which will undertake the manufacture of a new form of lightning arrester recently invented by Mr. Reid. The device is intended for pole line or station use and its field is restricted to the lower voltages.

The arrangement in this arrester differs from that of the types at present in use on the market, in two principal respects. The principal departure from existing forms is that practically no resistance is offered to the passage of the discharge during the ordinary periods of such discharges. It consists, as shown by the accompanying illustrations, of a wood box with asbestos wood compartments, usually seven in number, all covered with one door. The large compartment at the left facing the box is arranged with a number of carbon gaps, which are spaced by 20 mills, each one of these gaps being in series with a fuse, with each fuse wired in a separate compartment and joined to separate lever arms, the upper lever arm being in direct connection with the ground wire. The line to be protected is connected through a disconnecting switch at the side of the box to one side of all the carbon gaps, and as discharges take place they successively blow the fuses from the top downward. As each fuse blows its lever arm drops and makes contact through a carbon point (to prevent "freezing") with a lug connected with the lever arm below, thus making the ground for the next protecting gap and fuse.

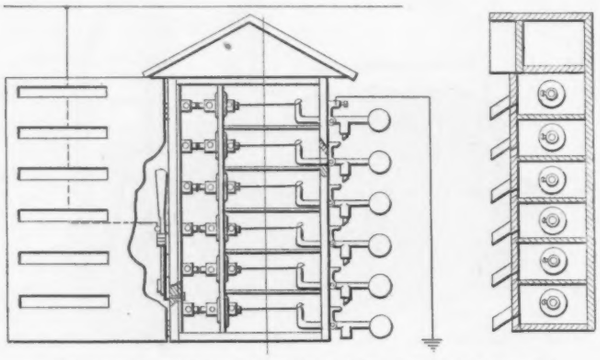


FIG. 1.—DIAGRAM OF LIGHTNING ARRESTER CONNECTIONS.

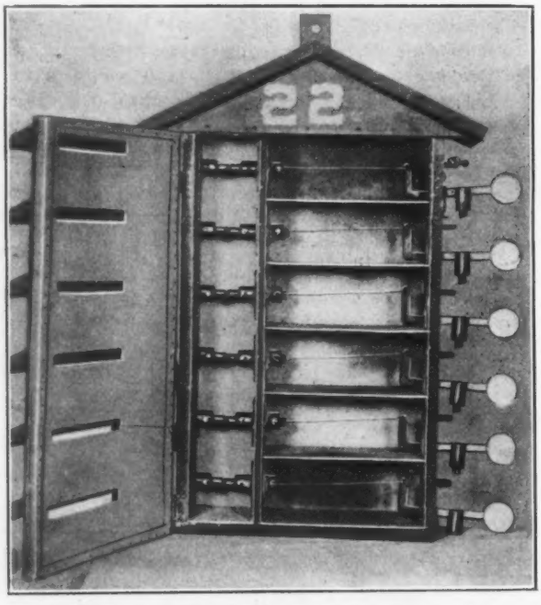



FIG. 2.—VIEW OF INTERIOR OF LIGHTNING ARRESTER.

The size of compartments and length and size of fuse wire have been developed by very thorough experiments, and it is claimed that the device will give protection where other types of arresters had failed.

Some hundreds of these arresters have been installed during this season on the trolley and trolley feeders of the Colorado Springs & Interurban Railway Company, and in spite of the fact that the season has been the most severe electrically for many years, no car armatures have been lost or station machinery injured by lightning entering over wires protected by these arresters. This is an exceptionally good record, as during last year, a comparatively mild year for this district, the Colorado Springs & Interurban Railway had some 20 armatures burned out by lightning, although the lines were very heavily equipped with the standard types of arresters.

The lever arms form a sort of semaphore, and by dropping serve to indicate the number of discharges which have been taken care of and indicate the readiness of the arresters to care for other discharges. The arrester offers an absolutely straight path without resistance for discharges, and it is claimed that many discharges which would before cause severe bucking, are now taken care of so easily as to be unnoticeable on the cars, although possibly dropping two or three of the semaphore arms in an arrester immediately above the car. The maximum number so far noted as dropping with any one discharge is two arms, and the present arrangement includes only six fuses, although this number could be increased.

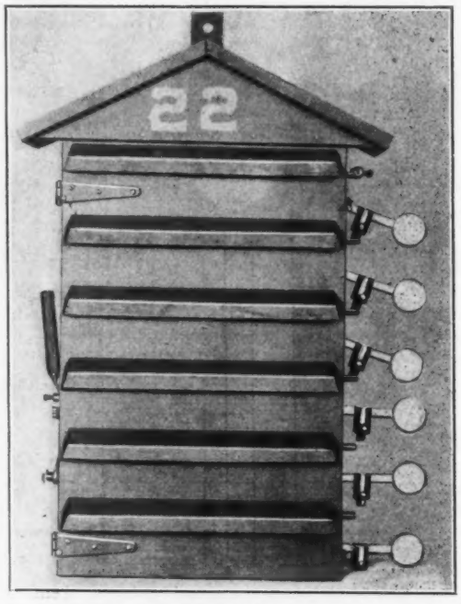



FIG. 3.—LIGHTNING ARRESTER CLOSED, SHOWING POSITION OF SEMAPHORES.

The Rocky Mountain region is usually considered to be exceptionally severe in electrical storms, and it is difficult to secure adequate arrester protection. In other cities of this region it is an ordinary practice to stop cars, either individually, when near the center of an electrical storm, or frequently the entire power system, from half to three-quarters of an hour during the most severe electrical storms, in order to protect apparatus, and even then the losses are frequently severe.

Colorado Springs, with the protection afforded by this arrester, has no difficulty in maintaining its service at all times during storms, and it is expected that this will mean the extension of the use of this arrester throughout this district. In practice the operation of the arrester is easy, and the destruction of the carbon gaps very slow. The re-fusing is quickly and readily done with safety to the linemen by the pulling of the line switch, even if some other portion of the line is experiencing a storm. The size of the arrester, which may be somewhat modified later, is not objectionable, the largest dimensions being about 30 in. The regular manufacture of this device is expected to begin at once.

# Industrial and Commercial News

## *Financial Intelligence.*

### THE WEEK IN TRADE.

As the fall season advances there is more and more evidence that trade is rapidly nearing normal conditions. During the past week the business of the wholesalers and jobbers has expanded in a marked degree and buyers have been in all the central markets in great numbers. This activity is especially noted in dry goods and textile lines and in millinery. It must be remarked, however, that while buyers have taken hold quite freely, there is much greater conservatism than was in evidence in the flush days of 1906. There is practically no disposition to overload or to be reckless in the purchase of expensive wares. This is especially noticeable in the case of purchasers from the South, where the shortness of the cotton crop is admitted, and from the West where the corn crop will fall considerably below the earlier expectations. In the industrial world only the most encouraging reports are made. Employment is more general, payrolls are larger, and a number of employers have made wage advances. Building operations continue to be active, sustaining the demand for structural iron, and there was during the past week quite a considerable tonnage of steel rails ordered. In this latter particular several large orders are known to be pending. Railway equipment purchases have been fairly liberal and the demand for steel cars has forced advances in sheets. Collections are much improved. Failures for the week ended Sept. 2, as reported by *Bradstreet's*, were 166, against 201 for the same week last year, 210 in 1908, 130 in 1907, 121 in 1906 and 137 in 1905.

### THE COPPER MARKET.

There was only fair activity in the copper market last week, although there was considerable evidence that domestic consumption was improving. The producers assert that domestic takings during August will amount to 60,000,000 lb. and that imports will be about 51,000,000 lb. Taking the production for the month to be about 118,000,000 lb. the same as during July—the months being of equal length—and there remains an apparent increase in stocks in this country of 7,000,000 lb. In the meantime the foreign statistics show that the visible supply of copper abroad increased during the month of August about 26,000,000 lb. and now amounts to approximately 200,000,000 lb. These figures are not encouraging. They mean that at home and abroad there is now in sight for sale more than 325,000,000 lb. The stocks that are not in sight are believed to be very heavy, for it is admitted that during July and August consumers bought far in excess of their actual requirements. From all of which it appears that without producing another pound there is enough copper on hand to last the world for five months. One of the features of the past week was the heavy reselling by speculators. These, it is said, were in many cases made at concessions, and were generally attributed to increased difficulty in financing long holdings. Final exports for the month of August were 22,839 tons, the smallest amount since March. The daily call in the Metal Exchange, at 12:30 o'clock, Sept. 3, quoted standard copper as follows:

| | Bid. | Asked. | Settling price. |
|---|---|---|---|
| Spot | 12.40 | 12.70 | ..... |
| September | 12.40 | 12.70 | 12.55 |
| October | 12.40 | 12.70 | 12.55 |
| November | 12.50 | 12.75 | 12.62½ |
| December | 12.60 | 12.85 | 12.72½ |

The London prices Sept. 3 were as follows:

| | Noon. | Close. |
|---|---|---|
| | £ s d | £ s d |
| Standard copper, spot | 59 2 6 | 59 2 6 |
| Standard copper, futures | 60 0 0 | 60 1 3 |
| Market | Easy. | Quiet. |
| Sales of spot | | 400 tons |
| Sales of futures | | 600 tons |

Extreme fluctuations for this year:

| | Highest. | Lowest. |
|---|---|---|
| Standard | 13.00 | 12.62½ |
| Lake | 14.55 | 12.55 |
| Electrolytic | 14.25 | 12.12½ |
| Casting | 14.12½ | 12.00 |
| London, spot | £64 2 6 | £54 12 6 |

BATTLES & COMPANY.—Announcement is made that a joint partnership has been formed under the name of Battles & Company to transact a banking, investment and brokerage business at 60 Broadway, New York, and 131 South Fifth Street, Philadelphia. The new firm will take over the business heretofore conducted by Battles, Heye & Harrison, and will be comprised of all of the members of that firm, with the addition of Pahud F. Thompson.

CHICAGO SUBWAY RUMORS.—The report that there is about to be a reorganization of the Chicago Subway Company is positively denied by interests heavily loaded up with the stock. Armour interests, which control the company, declare that the recent break in the price of the stock makes no difference in the value of the property and, that as they own their shares outright and do not want to sell, they are not interested in the market fluctuations.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY.—The report of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., for the year ended June 30, 1909, shows net earnings, after deducting $40,658 for repairs and maintenance, of $144,688. During the year the liabilities of the company were reduced $566,467, which was mainly accomplished through the collection of accounts and the conversion of investments. The surplus at the end of the year, after paying fixed charges and allowing $61,860 for depreciation, amounted to $28,028. The company's total surplus now is $136,898.

JASONVILLE (IND.) ELECTRIC COMPANY.—Plans have been approved for the installation by the Jasonville Electric Company, Jasonville, Ind., at that city of a combined electric and water-works plant. The cost of the electric system will be about $30,000, and of the water works about $50,000. It is proposed to extend the lighting system as far as Hymera, Ind. The Reliance Engineering Company, of Cincinnati, has drawn the plans for the new work.

TO OPEN THE GUNNISON CANAL.—The great Gunnison Canal, the first project undertaken by the United States Government Reclamation Service, will be opened by President Taft, Sept. 13, and the flow of the Gunnison River will be turned into the main canal and associate canals. This will irrigate about 150,000 of semi-arid lands in southwestern Colorado. This work has been under way for about 4½ years, and has just been completed. The cost of the tunnel and distributing canal will be more than $5,000,000. The water, after leaving the tunnel, will have a fall of 372 ft., which will probably be used to develop electricity which will be distributed for commercial purposes.

WASHINGTON POWER COMPANY.—A reduction of about 27 per cent has been made by the Washington Power Company at Spokane, Wash., in its rates for electricity for lamps. The new schedule, which went into effect Sept. 1, is on a sliding scale. The charges are for the first 30 kw, 10 cents per kw-hour; 9 cents per kw-hour for the second 20 kw; 8 cents for the third 20 kw, and 5 cents per kw-hour for all energy consumed above 60 kw.

TO INVESTIGATE CENTRAL STATION RATES IN BUFFALO.—The Civic Conference and Chamber of Commerce Committee on Municipal Affairs, of Buffalo, have started a movement for lower rates in that city for central station service, and propose to bring the matter formally before the Public Service Commission. It is stated that many experts will be called to support at the hearing the contention for lower rates.

BUFFALO GENERAL ELECTRIC COMPANY.—The Buffalo General Electric Company has commenced building a large fireproof office building at Washington, Huron and Genesee Streets. Special provisions will be made for show rooms in which all the latest methods of display will be used. The offices of the Cataract Power & Conduit Company, at present in the Fidelity Building, will also be located in this building.

HUDSON & MANHATTAN RAILROAD TUNNEL EXTENSION.—William G. McAdoo, president of the Hudson & Manhattan Railroad Company, is authority for the statement that the extension of the Sixth Avenue line to Thirty-third Street will be completed and open ready for operation on May 1, 1910, at which time it is expected that the new department store on that corner will begin business. Work at the present time has been completed up to Twenty-seventh Street, and the station at Twenty-eighth Street will be finished before the end of the year, but the line will not be opened above Twenty-third Street until the date indicated. With regard to the extension to the Grand Central station, it is announced that the company has already secured 35 per cent of the consents of property owners out of the 50 per cent that is required, and it is expected that the others will be secured within a few months, and that work will begin upon the tube before the end of the year. The Public Service Commission will have to approve the plans before work can be begun. The company is considerably hampered at this time by the failure of the Pressed Steel Car Company, on account of the strike, to deliver the cars ordered. Of the 90 that were contracted for only 30 have been received, and the road is short of operating equipment. Within a very short time through trains will be run from Twenty-third Street through to Cortlandt Street without change of cars at Hoboken. A two-minute service is now maintained during rush hours, and a better service will be installed as soon as sufficient equipment is received. The extension of the Jersey City tunnel to Summit Avenue will be completed before very long, and connection will there be made with the Pennsylvania Railroad tracks so that there can be a service through to Newark.

STANDARD GAS & ELECTRIC POWER COMPANY.—A $600,000 corporation has been formed under the laws of Pennsylvania by Samuel S. Eveland, president of the Standard Roller-Bearing Company, for the manufacture of commercial and pleasure automobiles. The name of the new company is to be the Standard Gas & Electric Power Company. Operations have already been begun at the plant of the new company in Philadelphia. Mr. Eveland has been developing the plans for the concern for a year and a half, and says that the books of the company already contain orders for $1,375,000 worth of output. The company will manufacture 35-hp touring cars to sell at $1,800 and three-ton commercial trucks to sell at $3,500. A feature of the car will be that it will combine gas and electric motive power. It will also have an automatic gear shift operated by the pressure of a button, to do away with the present lever system. It is said that the company will also manufacture an interurban railroad car to be operated by gas. The engine in this car will be only 75 hp.

IMPROVED ALUMINUM SALES.—There has been some improvement in the aluminum business within the past few months. According to a statement made by an official of the Aluminum Company of America, the sales of the company have shown a gradual increase, and there are more inquiries for future work than at any time within recent years. There have not as yet been any very important sales of aluminum wire for transmission, but there have been many small sales, and the manufacturers are confident that this material is growing in popularity. The prices for aluminum in ingots remain about the same, 21 to 23 cents per pound, according to quantities. Although the patents under which the Aluminum Company of America manufactured expired last spring, no other concern has as yet entered the field as a competitor. The demand for aluminum domestic utensils has increased very considerably, and showrooms have been opened at 99 John Street, New York, for the exhibition of these wares.

GREAT WESTERN POWER COMPANY.—H. H. Sinclair, vice-president and general manager of the Great Western Power Company, of San Francisco, who recently took up the general management of that company, is gradually placing in effect some important changes in both its organization and business policy. William S. Cone has been appointed assistant general manager and will also act as superintendent of construction. Mr. Cone was associated with the Edison Electric Company, at Los Angeles, for the past five years and also spent about a year as general manager of the Mount Whitney Power Company. Chester Pennoyer, who has been in charge of the construction works, has tendered his resignation to resume his former position as manager for the National Conduit & Cable Company on the Coast. C. W. Hutton, of the engineering department, has been promoted to the position of superintendent of operation. The general offices of the company will be moved from San Francisco to Oakland.

DEMAND FOR PLATINUM INCREASING.—According to the statements made by one of the largest platinum importing firms in this country, the demand for this metal has very considerably increased within the past few months. "Since the general improvement in business the demand from the jewelry trade for platinum has very largely increased," said this importer, "and the demand from the electrical companies is also much heavier." Quotations have not advanced materially, and platinum is now selling at from $25 to $27 per ounce.

TUNGSTOLIER COMPANY OF CANADA.—The Tungstolier Company of Canada has been incorporated with a capital of $48,000, and has been organized with the following officers: President, E. J. Kulas; vice-president and general manager, R. B. Basham; secretary, W. H. Wissing; treasurer, C. F. Koepge. Mr. Basham has been general Western manager at Chicago of the Tungstolier Company, of Cleveland, of which Mr. Kulas is president. The same financial interest controls the American and Canadian companies.

PROPOSAL FOR U. S. MARINE CORPS ELECTRICAL PLANT.—The Quartermaster, United States Marine Corps, Washington, will open bids in his office at 11 a. m. Sept. 20, for furnishing and installing complete, at the Depot of Supplies, Marine Corps, 1100 South Broad Street, Philadelphia, Pa., a horizontal side-crank engine, 15 in. x 20 in., a 100-kw, 220-volt, two-phase generator with switchboard complete. Proposals for the engine are to be submitted independently of the generator.

WESTINGHOUSE CONTRACTS FOR JAPAN.—Three 55-hp Westinghouse Machine Company gas engines have been installed by the Furawaka Coke Works, of Tokio, Japan, to operate their coal-washing plant. These engines will use as fuel the sulphur gas derived from the coke ovens. This new equipment is additional to a pair of 11 in. x 12 in., two-cylinder Westinghouse gas engines driving a 125-volt direct-current generator.

WESTERN GAS ENGINE COMPANY.—Orders have been placed with the Western Gas Engine Company of Los Angeles, Cal., for an initial engine and generator equipment of 450 hp, by the West Side Electric Company which proposed to construct a lighting plant near Maricopa, Cal. The new installation will be in operation by Oct. 15. Plans are being drawn to develop 900 hp additional in the near future.

4500-KW PLANT FOR LOUISVILLE.—C. W. Humphrey, consulting engineer, Chicago, is drawing up the plans for a 4500-kw generating plant for the Kentucky Electric Company, of Louisville, Ky. This plant will employ steam turbines, and is designed for an ultimate capacity of 10,000 kw. Bids will be invited soon. The water for condensing purposes will be taken from the Ohio River.

## *Financial Intelligence.*

### THE WEEK IN WALL STREET.

During the short week that preceded the three-day holiday there was very little business done in Wall Street. The market was fairly strong and prices advanced to a quite thorough recovery of their previous losses, but there was a lack of enthusiasm in the trading. It is not an unusual thing that traders are disinclined to carry heavy commitments over a holiday. In fact it is the regular thing. There was little to stimulate activity in the ordinary happenings of the week. The excitement over the condition of Mr. Harriman's health having subsided, the crop situation being practically settled and there being no financial disturbances, the market simply loafed along on the upward course, which the increasing commercial prosperity of the country seems to warrant. One effect of this was the sharp advance in United States Steel common. This was easily the feature of the week. On Sept. 3, the last day of trading, this issue reached 80¼, the highest point in its history. The volume of trading was fairly large and predictions were freely made that par would be reached before the end of the year. The most encouraging point about this advance is that it can hardly be catalogued as speculative. It is the natural sequence of the reports that are being made daily of the business of the "Trust." It is given out that the production of pig

iron is running now at a rate in excess of the banner year 1907. The mills are busy to their limit and prices have been advanced to a profitable basis. There is plenty of talk to be heard about an increase in the dividend on Steel common and there is no doubt that the economies of operation inaugurated by the company will be reflected in larger net earnings. Among the stocks, not heretofore particularly active, which were prominent in the trading last week, were American Telephone & Telegraph and American Smelting & Refining. Transactions in each of these issues were large and prices advanced. Good earning reports were responsible in each case for this interest. There was a genuine desire on the part of outsiders to buy. This is one of the healthiest indications in the market. Whenever there is information that an industrial or a railroad is doing particularly well there always seems to be plenty of honest investment money ready to grab at the bargains. It has been shown for many months in the bond market and, this having been swept quite clean, investment is now turning to the better class of stocks. The money market continues to be easy and there is no trouble for investors and the better class of speculators to carry any purchases they make. Quotations Sept. 3 were: call 2¼ @ 2½ per cent, 90 days 3¼ @ 3½ per cent. The quotations in the table are those of the close Sept. 3.

NEW YORK.

| | Aug. 30. | Sept. 3. | Shares sold. | | Aug. 30. | Sept. 3. | Shares sold. |
|---|---|---|---|---|---|---|---|
| All.-Ch. ..... | 15½ | 15¼ | 2,300 | Int.-Met., pfd.. | 46¾ | 46½ | 5,925 |
| All.-Ch., pfd.. | 53½ | 53 | 1,400 | Mackay Cos.... | 84⅜ | 84 | 700 |
| Amal. Cop.... | 84¼ | 84 | 84,100 | Mackay Cos.,p. | 75 | 75⅛ | 840 |
| Am. D. T.... | 20½* | 20½* | —— | Man. Elev.... | 143* | 143* | —— |
| Am. Loc..... | 60 | 59⅜ | 14,600 | Met. St. Ry... | 23* | 23* | —— |
| Am. Loc., pfd. | 116 | 115 | 1,010 | N.Y. & N.J.Tel | 139¼* | 139¼* | —— |
| Am. Tel. & Cbl. | 76* | 76* | —— | Steel, com.... | 77¾ | 80⅛ | 672,365 |
| Am. T. & T... | 140⅛ | 141⅞ | 27,720 | Steel, pfd..... | 125½ | 127¼ | 19,000 |
| B. R. T..... | 79½ | 79 | 13,070 | W. U. T..... | 74½ | 75¼ | 4,500 |
| Gen. Elec..... | 168⅛ | 166½ | 3,500 | West'h, com... | 86 | 86 | 3,420 |
| Int.-Met., com. | 14⅞ | 14⅛ | 2,900 | West'h, pfd... | 125* | 130 | 100 |

PHILADELPHIA.

| | Aug. 30. | Sept. 3. | Shares sold. | | Aug. 30. | Sept. 3. | Shares sold. |
|---|---|---|---|---|---|---|---|
| Am. Rys..... | 46¾* | 46* | —— | Phila. Elec.... | 12⅜ | 12⅛ | —— |
| Elec. Co. of A. | 12⅝ | 12¼ | —— | Phila. R. T.... | 30⅜ | 30¼ | —— |
| Elec. St. B'ty.. | 61 | 63¼ | —— | Phila. Trac.... | 90½* | 91* | —— |
| E. S. B'ty.pfd. | 49* | 30* | —— | Union Trac... | 54¼ | 53¾ | —— |

CHICAGO.

| | Aug. 30. | Sept. 3. | Shares sold. | | Aug. 30. | Sept. 3. | Shares sold. |
|---|---|---|---|---|---|---|---|
| Chi. City Ry.. | 180* | 180* | —— | Chi. Tel. Co.. | 135⅞ | 136 | —— |
| Chi. Rs.,Ser.1. | 110* | 110* | —— | Met. El., com. | 17¾* | 17¾* | —— |
| Chi. Rs.,Ser.2. | 37¾* | 37½* | —— | Met. El., pfd.. | 49* | 49* | —— |
| Com. Edison... | 121 | 120½* | —— | Nat'l Carbon... | 95* | 95* | —— |
| Chi. Sub'ws... | 20½ | 18⅜ | —— | Nat'l C., pfd.. | 120* | 120* | —— |

BOSTON.

| | Aug. 30. | Sept. 3. | Shares sold. | | Aug. 30. | Sept. 3. | Shares sold. |
|---|---|---|---|---|---|---|---|
| Am. T. & T... | 139⅞ | 141⅞ | —— | Mex. Tel..... | 2¼ | 2¼* | —— |
| Cum. Tel..... | 144 | 144* | —— | Mex. Tel., pfd. | 6* | 6* | —— |
| Edison E. Ill.. | 254 | 256 | —— | N. E. Tel.... | 136* | 136 | —— |
| Gen. Elec..... | 167½ | 167½ | —— | W. T. & T.... | 11 | 12½* | —— |
| Mass. E. Ry.. | 15* | 17 | —— | W. T. & T., p. | 89* | 89* | —— |
| Mass. E. R., p. | 74½* | 77 | —— | | | | |

*Last price quoted.
Shares sold are for week Aug. 30 to Sept. 3.

## DIVIDENDS.

American Smelting & Refining Company, preferred, quarterly, 1¾ per cent, payable Oct. 5; common, quarterly, 1 per cent, payable Act. 15.

Chicago Telephone Company, quarterly, 2 per cent, payable Sept. 30.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable Oct. 1.

North American Company, quarterly, 1¾ per cent, payable Oct. 1.

Oklahoma Gas & Electric Company, quarterly, common, 1¼ per cent, payable Sept. 15.

Philadelphia Traction Company, semi-annual, 2 per cent, payable Sept. 8.

Railways Company General, initial, 10 per cent, payable Sept. 15.

San Diego Consolidated Gas & Electric Company, common, quarterly, 1¼ per cent, payable Sept. 15.

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.—The earnings of the Cumberland Telephone & Telegraph Company for the month of July continue to show an increase. The gross earnings for that period were $536,985, an increase of $32,621 over the corresponding month last year. The net earnings were $193,166, an increase of $16,385 over the same month last year. The growth of this company has been something enormous since its beginning in 1894. At that time the capital stock was $1,695,700, and the net earnings for the year were $137,212; in 1908 the capital stock was $19,680,150, and the net earnings were $1,993,607. The rate of dividend has increased in that time from 4 per cent to 8 per cent. On July 1, 1909, the company had 201,422 subscribers. Extensive improvements are being contemplated in the Memphis territory, which include part of Western Tennessee, Northern Mississippi and Southwestern Kentucky. Part of the line between Memphis and Jackson, Miss., is to be built; a new line is to be erected in Mississippi btween Winona and Starkville, a distance of about 75 miles, and a new line will be built from Union City, Tenn., to Jordan, Ky. The cost of the entire improvements is estimated to be about $100,000.

BURBANK POWER & WATER COMPANY.—The property and holdings of the Pasco Power & Water Company, of Pasco, Wash., have been transferred to a group of Seattle capitalists, who have organized a new company under the name of the Burbank Power & Water Company. The properties transferred include valuable water rights on the Snake River at Five Mile Rapids, four miles above Pasco, and several thousand acres of land on the Columbia River in the fruit belt. They also include a water-power plant, irrigation system and townsite at Burbank in Walla Walla County. James D. Hoge is president of the new company. An issue of $500,000 in bonds will be made.

ALBANY & HUDSON RAILROAD REORGANIZATION.—The plans for reorganizing the Albany & Hudson Railroad Company, proposed by the committee representing a large number of the stockholders and bondholders, have been approved by the Public Service Commission of the Second District of New York. These plans were detailed in our issue of Aug. 12, and contemplate the formation of a new company, the stock of which will be given for the outstanding stock and bonds, and for a new bond issue of $1,500,000. The commission announces that it will subsequently take testimony as to the amount of new securities that should be issued.

GENEVA & AUBURN (N. Y.) RAILWAY BONDS.—The Public Service Commission of the Second District of New York has authorized the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company to execute a mortgage to the West End Trust Company of Philadelphia, under the corporate name of the Geneva & Auburn Railway. The corporation is authorized to issue at once $500,000 30-year, 5 per cent bonds to be sold at not less than 90. Of this amount $400,000 is to be used to discharge outstanding bonds and the balance for extensions and new equipment.

MINNESOTA LIGHTING COMBINATION.—The Washington County Light & Power Company, of Stillwater, Minn., has taken over the gas and electric light properties of the Apple River Power Company and the Western Gas & Improvement Company at Riverdale and Somerset, Wis. It is said that improvements are contemplated which will involve the expenditure of $210,000.

DEER RIVER POWER COMPANY.—The Public Service Commission of the Second District of New York has authorized the Deer River Power Company, of Copenhagen, N. Y., to exercise its franchises in that city, and to issue capital stock amounting to $25,000, the proceeds of which are to be used to pay the cost of organization, and in the purchase of water rights at High Falls, on Deer River.

ELMIRA WATER, LIGHT & RAILROAD COMPANY.—The proposed issue of $196,000 5 per cent bonds by the Elmira Water, Light & Railroad Company has been approved by the Public Service Commission of the Second District. The bonds cannot be sold for less than 85 and all but about $60,000 of the proceeds are to be used for extensions and betterments.

BUFFALO RAPIDS POWER COMPANY.—Articles of incorporation have been filed in Montana for the incorporation of the Buffalo Rapids Power Company with a capital of $300,000 to use the water of the Yellowstone River for a hydro-electric plant and for irrigation purposes. A dam will be built in the Yellowstone which will cost $250,000.

CALERA (ALA.) WATER & LIGHTING COMPANY.—A new company will soon be organized in Alabama called the Calera Water & Lighting Company, which will build an ice-making plant and water-works system. It is capitalized at $25,000.

MICHIGAN POWER INCORPORATIONS.—In connection with the many new power companies recently incorporated in the State of Michigan, reference to which was made in our last issue, the following list of companies, with their capitalization, has been received: The incorporators of the majority of these companies are E. F. and H. K. Loud, of Au Sable, Mich., who have long been known to control the power situation on the Au Sable River. In connection with them are the Hodenpyl, Walbridge & Company interests, of New York, and the E. W. Clark & Company interests, of Philadelphia. In addition to the four companies mentioned last week, these have been incorporated: Cooke Hydro-Electric Generating Company, Detroit, $100,000; Five Channels Hydro-Electric Generating Company, Detroit, $50,000; Loud Hydro-Electric Generating Company, Detroit, $100,000; Lewis Hydro-Electric Generating Company, Detroit, $100,000; Rock Hydro-Electric Generating Company, Detroit, $50,000; Au Sable Electric Generating Company, Detroit, $500,000; Wells Hydro-Electric Generating Company, Detroit, $100,000; Bamfield Electric Generating Company, Detroit, $50,000; Mansfield Hydro-Electric Generating Company, Detroit, $100,000; Rogers Hydro-Electric Generating Company, Detroit, $100,000; Baker Hydro-Electric Generating Company, Detroit, $50,000; Mio Hydro-Electric Generating Company, Detroit, $100,000; State Road Hydro-Electric Generating Company, Detroit, $100,000. The new companies will have plants in Oakland, Gennessee, Arenal, Iosco, Bay, Osceola, Alcona and Eaton counties. By Michigan capitalists not associated with the interests incorporating the above companies, the following articles were filed Aug. 31: Little Muskegon Water Power Company, capital $125,000; Montcalm Electrical Company, $75,000; Western Hydro-Electrical Company, $500,000, all of Grand Rapids, with Bruce Goodfellow, of Detroit, as trustee, holding the larger share of the stock. Associated with him are Orrin T. Bolt, of Muskegon, and Jay Reach and Robert T. Hughes, of Grand Rapids. A number of land and lumber companies were also incorporated before the end of August. The explanation of this rush of incorporations in Michigan is the fact that a new law went into effect Sept. 1 making it necessary for all corporations doing any sort of public-utility business to obtain the permission of the Railroad Commission before making any increase or change in capitalization. It is said that a combined attack by the power companies of the State will be made on the new law.

BOND ISSUE ENJOINED.—A temporary injunction has been issued by the United States Court of Montgomery, Ala., restraining the Citizens' Light & Power Company of that city from selling $500,000 worth of new bonds, for which a mortgage was recently recorded. The action which resulted in this injunction was brought by Daniel A. Cullinan, a stockholder. The main allegation in the suit is that the company, as originally incoporated, had only $50,000 of capital stock, and that under a law existing at that time corporations were prohibited from issuing bonds in excess of their capital. Another suit is pending against the same company in the Montgomery courts which involves an action brought by C. E. White, another stockholder, who asks to have the charter of the company declared void. In this suit it is alleged that a fictitious increase in the capital stock of the Citizens' Light, Heat & Power Company, the predecessor of the present company, had been made.

METROPOLITAN SECURITIES COMPANY.—The United States Court, New York City, has appointed Sidney Smith, a lawyer, as receiver for the Metropolitan Securities Company. This action was taken as a supplementary proceeding to the execution of a judgment for $5,271,582 obtained last February in the United States Court by William W. Ladd, receiver for the New York City Railway Company. This judgment was confirmed by the United States Supreme Court, and last week the United States Marshal of the New York District filed a report in court that he had been unable to discover any property belonging to the Metropolitan Securities Company on which to levy in order to satisfy the judgment. It was subsequent to this report that the receiver was appointed.

MARTIN MALONEY PURCHASES ROCK HILL (S. C.) PLANT.—Martin Maloney, of Philadelphia, purchased at receivers' sale Aug. 31, the entire property and franchise of the Rock Hill Water, Light & Power Company. The price paid was $80,000, which is $20,000 less than the liabilities of the company. The property will be brought up to date by the new owner.

## REPORTS OF EARNINGS.

| | Gross earnings. | Expenses. | Net earnings. | Charges. | Surplus. |
|---|---|---|---|---|---|
| **Aurora, Elgin & Chicago Railroad Company:** | | | | | |
| July, 1909 | $167,614 | $77,895 | $89,719 | $28,899 | $60,820 |
| July, 1908 | 148,748 | 72,208 | 76,540 | 27,778 | 48,762 |
| **Cape Breton Electric Company:** | | | | | |
| June, 1909 | 18,569 | 12,208 | 6,361 | 4,071 | 2,289 |
| June, 1908 | 19,959 | 11,564 | 8,394 | 4,046 | 4,348 |
| **East St. Louis & Suburban Railway Company:** | | | | | |
| July, 1909 | 170,250 | 92,371 | 77,878 | ..... | ..... |
| July, 1908 | 165,450 | 87,622 | 77,828 | ..... | ..... |
| **Edison Electric Illuminating Company of Brockton:** | | | | | |
| June, 1909 | 18,201 | 10,243 | 7,958 | 2,897 | 5,060 |
| June, 1908 | 14,833 | 8,145 | 6,688 | 2,390 | 4,297 |
| **Electric Light & Power Company of Abington and Rockland.** | | | | | |
| June, 1909 | 4,458 | 3,023 | 1,434 | 375 | 1,059 |
| June, 1908 | 4,315 | 2,525 | 1,789 | 354 | 1,435 |
| **Fonda, Johnstown & Gloversville Railroad Company:** | | | | | |
| Quarter ended June 30, 1909 | 211,396 | 92,187 | 119,208 | 93,444 | 25,263 |
| Quarter ended June 30, 1908 | 191,947 | 89,775 | 102,172 | 93,970 | 10,125 |
| **Galveston-Houston Electric Company:** | | | | | |
| June, 1909 | 105,802 | 57,805 | 47,996 | 18,669 | 29,327 |
| June, 1908 | 92,442 | 53,235 | 39,206 | 18,400 | 20,806 |
| **Houghton County (Mich.) Electric Light Company:** | | | | | |
| June, 1909 | 17,055 | 9,094 | 7,634 | 3,504 | 4,130 |
| June, 1908 | 15,994 | 9,457 | 6,202 | 3,202 | 2,965 |
| **Lowell (Mass.) Electric Light Corporation:** | | | | | |
| June, 1909 | 25,694 | 16,014 | 9,679 | 3,555 | 6,123 |
| June, 1908 | 25,494 | 16,125 | 9,369 | 4,006 | 5,362 |
| **Milwaukee Electric Railway & Light Company:** | | | | | |
| July, 1909 | 361,914 | 169,017 | 192,897 | 106,012 | 86,884 |
| July, 1908 | 336,888 | 160,883 | 176,005 | 99,989 | 76,016 |
| **Minneapolis General Electric Company:** | | | | | |
| June, 1909 | 82,416 | 37,855 | 44,561 | 29,546 | 15,014 |
| June, 1908 | 70,766 | 31,837 | 38,928 | 31,507 | 7,420 |
| **Northern Texas Electric Company:** | | | | | |
| June, 1909 | 103,307 | 57,027 | 46,280 | 17,189 | 29,090 |
| June, 1908 | 90,549 | 66,051 | 24,498 | 19,190 | 5,308 |
| **Ogdensburg Street Railway Company:** | | | | | |
| Quarter ended June 30, 1909 | 9,787 | 5,564 | 4,222 | 3,795 | 426 |
| Quarter ended June 30, 1908 | 8,821 | 6,982 | 1,839 | 3,468 | *1,628 |
| **Plattsburg Traction Company:** | | | | | |
| Quarter ended June 30, 1909 | 6,030 | 4,009 | 2,020 | 1,802 | 218 |
| Quarter ended June 30, 1908 | 5,575 | 3,722 | 1,852 | 2,086 | *233 |
| **Rochester Railway Company:** | | | | | |
| Quarter ended June 30, 1909 | 536,200 | 338,486 | 197,714 | 123,573 | 84,956 |
| Quarter ended June 30, 1908 | 597,216 | 404,589 | 192,627 | 126,209 | 67,452 |
| **Twin City Rapid Transit Company:** | | | | | |
| July, 1909 | 640,094 | 277,571 | 362,523 | 140,251 | 222,272 |
| July, 1908 | 606,373 | 278,138 | 328,235 | 128,361 | 199,874 |
| **Westchester Electric Railroad Company:** | | | | | |
| Quarter ended June 30, 1909 | 107,843 | 99,535 | 8,308 | 11,371 | *2,864 |
| Quarter ended June 30, 1908 | 97,747 | 104,102 | *6,355 | 9,819 | *16,037 |
| **Whatcom County (Wash.) Railway & Light Company:** | | | | | |
| June, 1909 | 30,605 | 18,039 | 12,565 | 8,085 | 4,480 |
| June, 1908 | 26,128 | 16,861 | 9,266 | 7,969 | 1,297 |

*Deficit.

# GENERAL NEWS

## Construction News.

CALERA, ALA.—Plans are being made to organize a company under the name of the Calera Water & Lighting Company to build lighting and ice plants and waterworks system. The company will be capitalized at $25,000. The Rossland Development Company, 211 Woodward Building, Birmingham, Ala., is interested in the project.

PHOENIX, ARIZ.—Preparations are being made by the Arizona Verde Copper & Gold Mining Company to commence extensive developments in the Black Hills district on the Emma Gray group. A complete electrical equipment will be installed.

PHOENIX, ARIZ.—H. P. DeMund, W. D. Fulwiler and Elliot Evans are reported to be interested in the project to construct a belt electric railway to connect with the new extension of the Indian school car line of the Phoenix Railway, and also a loop of 12 miles to end at Six Points and connect with the Grand Avenue line.

GURDON, ARK.—The Ohio Stave & Lumber Company, it is reported, is contemplating the installation of an electric light plant.

CHICO, CAL.—Investigations are being made by the Pacific Gas & Electric Company, with a view of locating sites for new plants on Mill Creek, in Tehama County, in this vicinity.

COLMA, CAL.—An election will soon be held to vote on the proposition to form a lighting district and for installing and maintaining a street lighting system in Colma.

MARICOPA, CAL.—Plans are being made by the West Side Electric Company for the construction of an electric light plant to supply electricity for the field. It is said that the main plant will be located on the lease of the Sunset Rex Company, near Maricopa, and the initial equipment will have a rating of 450 hp. Orders have already been placed with the Western Gas Engine Company for machinery. It is expected to have the plant in operation by Oct. 15, and to supply electricity in Maricopa at that time. The transmission lines will be extended to Midway and McKittrick as soon as possible. Contracts have also been placed for machinery to develop 900 hp in addition to the first installation. J. F. Stratton is vice-president and general manager of the company.

OAKLAND, CAL.—The directors of the Oakland & Antioch Railway Company have authorized a bonded indebtedness to raise funds with which to construct an electric railway from Oakland to Antioch by the way of Walnut Creek, Concord and Bay Point. A. W. Maltby is interested in the project.

SANTA BARBARA, CAL.—City Attorney Butcher proposes the construction of a municipal plant to generate electricity for lighting the city and operating the tunnel now being driven through Santa Ynez Mountains for a water supply, the cost being estimated at $10,000. The city attorney suggests that water now going to waste could be confined in a high-pressure pipe to feed a turbine water-wheel. There is a sentiment in town that the time is not yet ripe for the project.

SAN FRANCISCO, CAL.—Announcement has been made that the property of the Stanislaus Water Power Company has been transferred to the Sierra & San Francisco Power Company. This company will furnish electrical energy to the United Railroads of San Francisco. It is estimated that this service will make a saving of between $500,000 and $600,000 in the cost of operating the United Railroads of San Francisco.

SAN JOSE, CAL.—The Peninsular Railway Company, it is reported, will begin at once the construction of an electric railway from San Jose to Stanford University, a distance of 17 miles.

SENORA, CAL.—The La Grange Power Company is at work on considerable development work on the Tuolunine River in Stanislaus County. The new transmission line has been extended nearly to Modesto and a new substation is to be built at once. The storage capacity of the reservation is also to be increased.

DENVER, COL.—The great Gunnison Canal, the first project undertaken by the United States Government Reclamation Service, which has been under construction for four and one-half years, is completed and will be opened by President Taft, Sept. 23, turning the flow of the Gunnison River into the bore, main and distributing canals, which will irrigate 150,000 acres of semi-arid land. The cost of the tunnel and distributing canals, when completed, will be more than $5,000,000. The water after leaving the tunnel will have a fall of 372 ft., which can be utilized to generate electricity and distributed for commercial and industrial purposes.

GREELEY, COL.—The Colorado Telephone Company is planning extensive improvements to its system in Greeley and throughout Weld County, which will involve an expenditure of about $125,000. It is proposed to erect a new exchange building in Greeley and place its wires in aerial and underground cables.

RIFLE, COLO.—The transmission system of the Rifle Light, Heat & Power Company, recently organized, will have a potential of 11,000 volts from the hydro-electric plant above the city to city limits, where it will be stepped down at a substation to 2300 volts for distribution in the town.

TRINIDAD, COL.—It is understood that Frank P. Read, receiver of the Southern Colorado Power Company, with permission of the court, will soon place orders for new machinery for the new power station, which will replace the one destroyed by fire in June. The company is to be reorganized with a capital stock of $5,000,000.

WILMINGTON, DEL.—Preparations are being made by the New Castle Leather Company to build an addition to its power house, which will be equipped with a 250-kw, direct-current generator, belt-driven, to drive six 30-hp motors.

WILMINGTON, DEL.—The Street and Sewer Directors have adopted new specifications for street lighting. Bids will be received until Oct. 5, and the contract will go into effect April 1, 1910. The present contract with the Wilmington City Electric Company will expire Sept. 7, but it is expected that it will be extended until next April, when the new contract will go into effect. The incandescent lamps now in use are of 16 cp, but, under the specifications, they will be changed to 40 and 60 cp, and improved arc lamps will be used. The specifications call for at least 425 incandescent lamps and 300 arc lamps. Bids will be received for two-year and five-year terms, beginning April 1, 1910. Specifications may be obtained at the office of the department. Leslie V. Christy is secretary.

WASHINGTON, D. C.—Bids will be received by the Quartermaster, U. S. Marine Corps, Washington, D. C., until Sept. 20, 1909, for furnishing and installing complete, at the Depot of Supplies, Marine Corps, 1100 South Broad Street, Philadelphia, Pa., one horizontal side crank engine; one 100-kw, alternating-current, 220-volt, two-phase generator, with switchboard complete. Proposals to be submitted independently on generator.

WASHINGTON, D. C.—Bids will be received until Sept. 14 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Ostrich Bay, Wash., Schedule 1554—Compressed air locomotive, two electrically driven air compressors. Washington, D. C., Schedule 1605—A generating set and a set of spare parts. Charleston, S. C., Schedule 1607—A hand feed motor-driven panel raiser, a blind stile borer and mortiser. Norfolk, Va., Schedule 1609—A heavy duty gasoline engine. Bids will also be received until Sept. 21 as follows: Mare Island, Cal., Schedule 1586—A three-motor overhead traveling electric crane; Schedule 1587—A motor-driven two-plunger single-acting hydraulic pump. Puget Sound, Wash., or Brooklyn, N. Y., Schedule 1611—Electric motors and spare parts. Applications for proposals should designate the schedules desired by numbers.

MACON, GA.—A number of land owners along the line of the Central Georgia Power Company transmission route have been served with legal notices, and condemnation proceedings will be ordered where necessary, thus insuring the speedy entrance of a hydro-electric transmission line into Macon. The energy will be transmitted from Capps Shoals and Lloyd Shoals. W. Jordan Massee is president of the company.

SENOIA, GA.—At an election to be held Sept. 11, the proposition to issue $10,000 in bonds to establish an electric light plant will be submitted to the people.

PECK, IDAHO.—It is reported that D. E. Peck, owner of the Peck flour mill, is planning to install an electric plant in connection with the mill and will furnish electricity to the mines in this vicinity.

SANDPOINT, IDAHO.—The Idaho & Montana Power Company has commenced work on the construction of the transmission line from this city to Newport, which will supply electricity in Newport and all adjacent towns from Sandpoint. H. H. Bylsbey & Company, of Chicago, Ill., are owners of the plant here. Improvements to the extent of $2,000,000 are planned. R. Tappan Tannatt, of Spokane, Wash., has been retained as chief engineer of work of construction of the power plant on Priest River.

CHAMPAIGN, ILL.—The capital stock of the Illinois Traction Company has been increased from $13,000,000 to $16,000,000.

CHICAGO, ILL.—Bids will be received until Sept. 13 by the South Park Commissioners for furnishing approximately 70,000 ft. of single electric conduit, to be delivered at specified points over the South Park system. E. G. Shumway is secretary.

GALENA, ILL.—The Des Moines Bridge & Iron Company has secured the contract for the construction of a large power house for the Interstate Construction Company. Improvements are contemplated by the company which will involve an expenditure of about $150,000.

HUNTINGTON, IND.—B. F. Burke, of Marion, Ind., is reported to have petitioned the City Council for a franchise for an electric light, heat and power plant.

INDIANAPOLIS, IND.—The proposed lighting of the Central business streets of this city by the Peacock-Wooley Light Company, of Chicago, in exchange for the advertising privileges on the lamps, is about to be held up on account of the alleged disfiguring of the "city beautiful." The Board of Public Works is opposing the plan on the ground that ten lamps to the square would "make the street look like a torch-light procession." It has been decided to test a few of the tungsten lamps and note the appearance before closing the contract.

JASONVILLE, IND.—The Jasonville Electric Company is preparing to install a combined electric and waterworks plant. The cost of the electric system is estimated at about $30,000 and the waterworks at $50,000. It is proposed to extend the electric lighting system to Hymera, Ind. The Reliance Engineering Company, of Cincinnati, Ohio, has charge of the engineering work.

MOROCCO, IND.—A mutual telephone company has been organized by the citizens of Rensselaer and Jasper counties for the purpose of establishing and operating telephone lines in Jasper, Newton, Pulaski and White counties. The capital stock of the company is placed at $50,000.

SOUTH BEND, IND.—It is reported that the Vandalia steam line from South Bend to Logansport will be equipped to be operated by electricity.

SOUTH BEND, IND.—At a recent meeting of the directors of the Home Telephone Company, the sum of $50,000 was appropriated for the improvement and modernizing the company's plant. Work on the improvement will begin soon.

VALPARAISO, IND.—The Northwestern Indiana Telephone Company has notified the Secretary of State that the capital stock of the company had been increased from $50,000 to $100,000, the proceeds to be used in extending the lines and new equipment.

NEVADA, IA.—The electric plant owned by the Nevada Electric Company, which supplied the city with light and water, was destroyed by fire Aug. 26, leaving the city without either light or water service. Efforts will be made to have a temporary plant in service at once. F. E. Harris is owner of the plant.

RED OAK, IA.—The power plant of the Red Oak Electric Company is reported to have been badly damaged by the breaking of a fly wheel.

CALDWELL, KAN.—The citizens are considering the question of making extensions and improvements to the municipal electric light plant and water-works system. An election will soon be called to vote on the proposition to issue $30,000 in bonds to pay for the same.

LUCAS, KAN.—At an election held Aug. 19 the citizens voted to issue $30,000 in bonds for the construction of an electric light plant and water-works system, of which $10,000 will be used for electric plant and $20,000 for water works.

FORT LEAVENWORTH, KAN.—Sealed proposals will be received at the office of the Constructing Quartermaster, Fort Leavenworth, Kan., until Sept. 16, for extending and making certain changes in the electric lighting and fire-alarm systems at Fort Leavenworth. Full information and blank proposal forms will be furnished on application to the above office. Plans and specifications may be seen at this office, also at the offices of Chief Quartermaster, Omaha, Neb.; Depot Quartermaster, St. Louis, Mo., and Master Builders' Exchange, Kansas City, Mo. Capt. William D. Davis, is quartermaster.

HUTCHINSON, KAN.—The Southwest Kansas Independent Long Distance Telephone & Telegraph Company is contemplating the erection of a telephone line from Hutchinson to Liberal, a distance of 200 miles.

WAKEENEY, KAN.—We are informed that bids will be opened Sept. 15 for the construction of an electric light plant, the cost of which is estimated at $10,000. George P. Taylor, of Stockton, Kan., is engineer.

CADIZ, KY.—Plans are being considered by A. P. White & Company for the installation of an electric-light plant in Cadiz. The company, it is said, has agreed to install the plant this fall if the City Council will contract for 12 or more street lamps. Power will be secured from the dam at the mill of the company in Cadiz. Gasoline engines will also be installed to furnish power during the low-water periods.

CARLISLE, KY.—The Carlisle Telephone Company, which is controlled by the East Tennessee Telephone Company, has applied to the City Council for a franchise to operate in this city. The company has been operating an exchange in this city for several years by permission, but has no franchise. It is said that the company will make improvements to its plant if granted a franchise.

JEFFERSONVILLE, KY.—All of the private telephone lines operating in the eastern part of the county have been absorbed by the New Washington Telephone Company.

NEW IBERIA, LA.—H. A. Mentz, representing New Orleans capitalists who are trying to secure a franchise to construct and operate an electric railway through this city, and a suburban line to Jeanerette, has submitted a proposition to the Municipal Electric Light and Water Works Board, offerng to lease the municipal electric light and water plant for a term of 25 years. He agrees to furnish the city, free of cost, the quantity of water and electricity it is now using, and to charge only $6 per year for each additional 16-cp incandescent lamp required, and $75 per year for each additional arc lamp and $50 each for additional water hydrants. He also agrees to have the plant entirely renovated and running within nine months, and the electric railway system between this city and Jeanerette, and within the city limits within two years. The present rates for electricity and water furnished to private citizens are not to be increased.

LAKE CHARLES, LA.—The Cumberland Telephone & Telegraph Company is planning to make extensive improvements to its local system, which will involve an expenditure of approximately $65,000. The company is also considering the question of erecting a telephone line from Lake Charles to Cameron Parish in the near future.

BELFAST, MAINE.—The Penobscot Bay Electric Company expects to have its transmission line completed and to be ready to furnish electrical service in Belfast by Nov. 1. Several local industries have made arrangements to secure electricity from the company to operate their plants. The power company has opened an office in this city under the management of A. C. Hopkins, formerly superintendent at Bucksport.

BALTIMORE, MD.—Separate bids, marked "Proposals for Mantle Street Lighting," "Proposals for Incandescent Electric Street Lighting," "Proposals for Iron Lampposts" and "Proposals for Testing Electric Meters," addressed to the Board of Awards, care of J. Sewall Thomas, Register, City Hall, Baltimore, Md., will be received until Sept. 15, in accordance with specifications, which can be secured at the office of the superintendent of lamps and lighting, City Hall, Baltimore, Md. Robert J. McCuen is superintendent of lamps and lighting.

BOSTON, MASS.—Bids will be received at the United States Engineer Office, Boston, Mass., until Sept. 30 for boilers, engines and generators for Philippine Islands. For further information apply to Lieut. Col. Edward Burr.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston on Sept. 1 formally took over the operation of the electric plants of the Waltham Gas & Electric Company, Newton & Watertown Gas & Electric Company, the Boston Consolidated Gas Company and the Chelsea Gas Company. Owing to the consolidation, the cost of electricity in several suburban places will be reduced 25 per cent. The charge in Allston, Brighton, Brookline, Waltham and Chelsea will hereafter be 12 cents, instead of 16 cents. In Newton and Watertown it has been 12 cents since Jan. 1, when a reduction was made from 18 cents, which was made on the condition of the Gas Commission's approval of taking over the properties of the Newton & Watertown Gas Company. It is understood that the Waltham power house will be used by the Edison Company, but that the Allston power station, from which Brookline, Allston and Brighton are supplied, will eventually be abandoned, and these sections supplied from the South Boston power house.

MILFORD, MASS.—The Selectmen have signed a new contract with the Milford Electric Light & Power Company for street lighting for one year. The company is to furnish 42 arc lamps of 1200 cp and 72 tungsten lamps. The tungsten lamps will replace 16 of the arc lamps now in use. The cost of the service will be $5,000 per year, and the town will have more lamps without additional cost.

NORTON, MASS.—The Selectmen have granted the Norton Electric Light & Power Company, of Chartley, permission to extend its transmission lines from Chartley to the center of this town.

PLAINVILLE, MASS.—The installation of an electric system to furnish electricity for lamps and motors in Plainville is under consideration. Tungsten lamps will be used for street lighting and electrical power will be utilized by the jewelry factories. Electrical energy for operating the system may be purchased from the North Attleboro municipal electric light plant. William Plattner is superintendent of the North Attleboro plant.

BATTLE CREEK, MICH.—H. C. Hawk, representing the Post Land Company, has applied to the Board of Supervisors for a franchise to construct and operate an electric railway through its property, just west of the city in Battle Creek Township. The railway will be about six miles in length.

DETROIT, MICH.—Bids will be received at the office of Departments of Parks and Boulevards, City Hall, Detroit, Mich., until Sept. 13 for 20 pedestal one-lamp posts, including lamp and fixtures complete for 110-volt, alternating-current. Posts to be similar to Claw & Son's' No. A-973 lamp post. M. P. Hurlburt is commissioner.

GRAND RAPIDS, MICH.—Those interested in the Muskegon Production Company and the Western Power Company, reported as incorporated by parties interested in the Grand Rapids-Muskegon Power Company, in the issue of Sept. 2, it is said disclaim any connection with the Grand Rapids-Muskegon Power Company. John G. Emery, Jr., one of the incorporators of the Muskegon Production Company, states that the company was organized to hold flowage rights, with no immediate plans for power development. The incorporators of the company are John G. Emery, Jr., R. H. Minty and G. H. Emery. The Western Power Company was incorporated by George L. Erwin, Oscar Waer and H. B. Erwin.

DETROIT, MINN.—Bids will be received by W. L. Taylor, president of the City Lighting Committee, until Sept. 14, for the installation of a light, power, water and heating plant in Detroit. Steam and electric equipment, water mains, intake pipes and pumps are included. The cost is estimated at $75,000. L. P. Wolff, of St. Paul, Minn., is engineer.

FAIRFAX, MINN.—The question of establishing an electric light plant in Fairfax is reported to be under consideration.

GLENWOOD, MINN.—The installation of an electric light plant in Glenwood is under consideration. Mr. Templeman is reported to be interested in the project.

HAWLEY, MINN.—The contract for the construction of electric light plant and waterworks system has been awarded to Fairbanks, Morse & Company, of St. Paul, Minn. Oscar Claussen, of St. Paul, Minn., is engineer.

WILLMAR, MINN.—The special committee appointed by the Council recommends that plans and estimates be prepared for the installation of a municipal telephone system.

MACON, MISS.—The City of Macon is contemplating the purchase of entire new equipment for the municipal electric light plant. The present plans call for the installation of two 50-kw, single-phase, revolving field generators; one steam exciter set; one motor-driven exciter set; one 4-in. vertical-shaft Volute pump direct connected to a single-phase, 2300-volt motor, having a rating of 250 gal. per minute against a head of 160 ft., which will require a 25-hp motor; one 3-in., two-stage turbine pump having a rating of 250 gal. per minute against a head of 180 ft., which will require a 25-hp motor; one 2-in., single-stage turbine pump having a rating of 75 gal. per minute against a head of 25 ft., which will require a 2-hp motor. G. B. Baskerville is superintendent.

CHILLICOTHE, MO.—An election will soon be held to vote on the proposition to issue bonds, the proceeds to be used for purchasing and improving the present electric plant and water works system, or the construction of a new combined plant. About $150,000 in bonds will be issued. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., successors to the W. A. Fuller Company, has been retained as engineers.

LIBERAL, MO.—The Liberal Rolled Feed Mill & Elevator Company is planning to install an electric plant, the equipment of which will include a 30-kw direct-current generator.

ST. LOUIS, MO.—James D. Houseman has been granted a franchise by the county court to construct an electric railway from Jefferson Barracks to Spanish Lake. The franchise provides for branch lines to Fenton and other towns which have no transportation facilities.

CLAY CENTER, NEB.—It is reported that M. M. Johnson, of this town, is contemplating the installation of an electric light plant to furnish electricity for lamps and motors in Clay City.

GOLDFIELD, NEV.—The Walker River Power Company has placed surveyors in the Lucky Boy Mining District to locate reservoir sites between Bridgeport, Cal., and Sweetwater, Nev. Two sites are said to have been selected which will send water back four miles. The purpose is to furnish electricity for lamps and motors for all districts around Lucky Boy.

MANCHESTER, N. H.—Plans have been completed by the Amoskeag Manufacturing Company for the installation of a large electric power plant to furnish electricity to operate the new Coolidge mill, now under construction. The plant will be equipped with two 3500-kw generators and horizontal Curtis turbines. The Coolidge mill will be equipped with 100 25-hp motors, fourteen 50-hp motors, seven 200-hp motors, two 185-hp motors, one 850-hp motor and several elevator motors. The plant will eventually furnish electricity for lamps and motors for the Amory, Jefferson and Langdon mills. The construction of the power house will probably not be completed before next February or March.

ORANGE, N. J.—Sealed proposals will be received by the Common Council until Sept. 20 for the installation of a municipal electric light plant, in accordance with plans and specifications, copies of which may be seen at the office of Runyon & Carey, 122 Market Street, Newark, N. J. All proposals to be directed to Willett B. Gano, city clerk, Canfield Street Engine House, Orange, N. J.

COPENHAGEN, N. Y.—The Deer River Power Company has received authority from the Public Service Commission, Second District, to exercise its franchises in Copenhagen, and to issue capital stock to the amount of $25,000, the proceeds to be used to pay the cost of organization and its indebtedness in the purchase of certain water powers, riparian rights and land at High Falls, on Deer River.

HUDSON, N. Y.—The contract for the new power house and coal pocket for the women's refuge in Hudson was awarded Aug. 31 to John Dyer, Jr., of Albany, N. Y., for $50,200.

LITTLE FALLS, N. Y.—Plans are being made to develop the water power of East Canada Creek, to furnish power for another large electric plant for the Inghams Mills. Guy R. Beardsley, president of the East Creek Electric Light & Power Company is promoter of the project.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Docks, Department of Docks and Ferries, Pier "A," foot of Battery Place, North River, New York, until Sept. 13 for furnishing and delivering iron, steel, pipe valves, electrical supplies, etc., as per contract No. 1162. Blank forms and further information may be obtained at the office of the Department. Denis A. Judge is deputy and acting commissioner.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Docks, Department of Docks and Ferries, Pier "A," foot of Battery Place, North River, New York, until Sept. 14 for furnishing all material and labor and appliances, etc., to complete the electric installation at the department yards at West Fifty-seventh Street, North River, and East Twenty-fourth Street, East River. Blank forms and further information may be obtained and plans and drawings may be seen at the office of said Department. Denis A. Judge, deputy and acting commissioner.

OLEAN, N. Y.—Arranagements have been completed by the Olean Electric Light & Power Company for doubling the output of its plant. The interior of the power house is being entirely remodeled, including the installation of two 200-hp gas engines with new generators.

SENECA, N. Y.—The Board of Public Service Commission, Second District, has authorized the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company to execute a mortgage to the Western Trust Company, of Philadelphia, Pa., to secure bonds to the amount of $2,500,000. The company is granted permission to issue at present $500,000 in bonds, to be sold at not less than 90; of the proceeds $400,000 are to be used for the discharge of outstanding bonds of the corporation and $100,000 for the acquisition of property and for extensions and improvements.

SYLVAN BEACH, N. Y.—At an election held recently, the citizens voted in favor of the proposition to install an electric light and power plant. Edmund Brown is clerk of the Board of Trustees.

ASHEVILLE, N. C.—The progress of the Asheville & East Tennessee Railroad Company, which recently began in a modest way as the Asheville-Weaverville electric line, about ten miles in length, is now said to be assured of backing ample to push the line on to connect with the new Clinchfield Railway from West Virginia to the Atlantic Coast, tapping the railroad probably in Yancey County. The electric railway has just received additional rolling stock enabling it to operate passenger, express and freight service to and from Weaverville, with the aforesaid promise to finally reaching the Clinchfield railroad.

HICKORY, N. C.—The A. A. Shuford Mill Company, recently incorporated with a capital stock of $80,000 for the purpose of manufacturing cotton yarns, will use electricity for motive power and has already contracted for 200 hp.

HICKORY, N. C.—The transmission lines of the Southern Power Company will be completed to Hickory, a distance of about 125 miles from the generating plants, by November 1, according to present plans. The Thornton Light & Power Company will handle 400 hp from the Southern Power Company, using 150 in its own plant, the remainder to be distributed among numerous industries in the town and vicinity. The Thornton Company will control the power only within the city limits; outside, where a number of larger industries are located, the Southern Power Company will have full sway. Col. Thornton, of the local company, declares that he now has in sight the money for developing a water power on the Catawba River, near Hickory, from which he proposes to supply several smaller towns to the north of Hickory with electricity.

FAYETTE, OHIO.—The contract for installing an electric lighting system, bids for which were opened Aug. 28, was awarded to George F. Avis and J. Mills Lamb, of Hudson, Mich. The contract also includes street lighting service at the rate of $60 per lamp per year. Electricity for operating the system will be secured from their plant located in Morenci, Mich.

GIRARD, OHIO.—The Youngstown Consolidated Gas & Electric Company, it is said, contemplates making extensions and improvements to its local system, if certain concessions are granted.

ENID, OKLA.—We are informed that the Enid & Central Oklahoma Traction Company proposes to commence work on the construction of its proposed electric railway from Enid to El Reno, 65 miles in length, about Oct. 1. The company expects to furnish electricity for lamps to towns along the route. W. S. Whittinghill, of Enid, is president of the company.

NINNEKAH, OKLA.—The Ninnekah Electric Light & Power Company is reported to have made arrangements to secure electrical energy for lamps and motors from the hydro-electric plant on the Washita River. E. W. Dent is general manager.

SAPULPA, OKLA.—The plant and holdings of the Sapulpa Light & Power Company have been purchased by H. Miller Hammett, of Tulsa, Okla.; and A. Measley, of Philadelphia, Pa. (the latter represented by T. F. Fulkerson, of Trenton, Mo.) for $150,000. It is understood that improvements to cost $50,000 are to be made to the plant at once.

TALOGA, OKLA.—Plans are being considered for the installation of an electric light plant and waterworks system, bonds for which were recently voted.

BAKER CITY, ORE.—Surveys are being made by the Baker Interurban Railway Company for its proposed railway from Haines to North Power and Rock Creek. It is said that work on construction of the road will commence within a few weeks. Electricity or gasoline will be used for motive power. T. B. Neuhausen, of Portland, Ore., is president of the company.

MEADOW BROOK (P. O. MULINO), ORE.—Preparations are being made by the Canby Canal Company for the construction of a power plant in Meadow Brook, where it is now constructing a dam. The company proposes to furnish electricity for lamps and industrial plants.

UNION, ORE.—The citizens have voted in favor of the proposition to issue $25,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

WATERLOO, ORE.—The Lebanon Paper Mill Company is making extensive improvements to its plant, including the installation of two 500-hp water wheels and an electric generator.

DALLASTON, PA.—Owing to the York & Windsor Electric Company having served notice upon the Borough Council that, after the expiration of the present contract, the price for street lamps would be increased from $20 to $30 per lamp per year, the Council voted to install a municipal plant. The proposition will be submitted to a vote of the people. The contract expires July, 1910.

DRYVILLE, PA.—It is proposed to erect a telephone line from Topton to Dryville and New Jerusalem. R. H. Angstadt and Alan S. Angstadt are interested in the project.

JOHNSTOWN, PA.—The Johnstown Electric Light Company has filed an amendment to its charter, increasing its capital stock from $1,200,000 to $1,600,000.

LANCASTER, PA.—The Edison Electric Light, Heat & Power Company is installing a 3000-kw, three-phase, 25-cycle, alternating-current generator connected to a 6000-hp Parsons turbine.

LANCASTER, PA.—The Conestoga Traction Company is building a car barn, a rotary converter station and waiting room, about one-half mile east of Parkersburg on the Lancaster and Cartersville line.

LEBANON, PA.—The Ephrata & Lebanon Street Railway Company will soon apply for a charter. The railway will be 22 miles long, for which the right of way has been secured. It is now proposed to operate with gasoline motors. F. H. Shaw, of Lancaster, Pa., is consulting engineer.

MERCER, PA.—Proposals will be received by the Mercer County Commissioners until Sept. 18 for the construction of a power-house. J. E. Callahan, John Hassel and Frank P. Craag are commissioners.

MURRAYSVILLE, PA.—The Murraysville Telephone Company has increased its capital stock from $5,000 to $10,000.

PALO ALTO, PA.—The capital stock of the Palo Alto Heat, Light & Power Company has been increased from $5,000 to $1,000,000. The company is controlled by the Eastern Pennsylvania Railway Company.

PHILADELPHIA, PA.—Arrangements are being made by the Philadelphia Rapid Transit Company for enlarging its power plant on Market Street. Permits have been granted for the construction of a brick addition to the plant, 78 ft. x 85 ft. at the corner of Market and Thirty-third Streets, to cost $61,000.

PHILADELPHIA, PA.—A new company has been organized, under the name of the Philadelphia & Suburban Elevated Railroad Company, to construct an elevated railway on Twelfth Street from Johnson Street south to Glenwood Avenue on the north, and a parallel line on Thirteenth Street, which will be connected at each terminal by loops. Several branch lines will be built. Stewart S. Neff is president of the company.

BATESBURG, S. C.—The capital stock of the Delmar Telephone Company has been increased from $800 to $3,000.

GEORGETOWN, S. C.—It is reported that the proposed electric railway system here has materialized, that rolling stock and equipment has been purchased, the output of the local electric lighting plant has been increased to meet the larger power demand, and that the tracks will be laid soon.

GREENVILLE, S. C.—The Southern Power Company, of Charlotte, N. C., is just completing new transmission lines to this city, the first terminus to be run to the Monoghan cotton mills, where electricity will be used as motive power. It is predicted that every cotton mill in and about Greenville will have the electric drive installed within twelve months.

NEWBERRY, S. C.—The Southern Power Company has completed the survey for its transmission lines to this city and Whitmire, the lines to be about 40 miles in length, tapping the main transmission lines from the power plant at Great Falls to Greenville, S. C.

ROCK HILL, S. C.—The entire holdings, franchise and other properties of the Rock Hill Water, Light & Power Company were sold at auction on August 31 by P. A. Wilcox, receiver, of Florence, S. C., to Martin Maloney, a capitalist of Philadelphia, Pa., for $80,000. The liabilities of the company are said to have been about $102,000, including bonded debt, etc. It is said that the plant will be renovated by the new owner.

MEMPHIS, TENN.—The Cumberland Telephone & Telegraph Company is planning to make extensive improvements in the Memphis territory, which includes part of West Tennessee, Northern Mississippi and part of Southwest Kentucky. Part of the line between Memphis and Jackson, Miss., is to be rebuilt; a new line is to be erected in Mississippi, between Winano and Starkville, a distance of about 75 miles. A new line will also be built from Union City to Jordan, Ky., and another from Selmer and Adamsville; a new exchange will be installed in Selma to take care of the increasing business. Other improvements will be made in a number of West Tennessee towns, and also in several places in Kentucky. Extensions will be made to the lines in Memphis this fall, which will involve an expenditure of between $25,000 and $30,000. The cost of the entire work is estimated at about $100,000.

ALEXANDRIA, VA.—The Alexandria Electric Light & Power Company is contemplating extending its transmission lines to St. Elmo and Del Ray, for the purpose of furnishing electricity for commercial and street lighting purposes. It is said that the Town Council is considering a contract for lighting the streets with electric incandescent lamps, of which 28 will be placed in Del Ray and 12 in St. Elmo.

MARTINSVILLE, VA.—The Martinsville Cotton Mills Company, recently organized, has its building nearly completed and ready for machinery, and will install 18,000 spindles, 446 looms, etc., for manufacturing fine sheeting. The company has contracted with the city for 500 hp to be supplied from the municipal electric plant. It is said that the city officials are preparing to raise the city dam, so as to provide more power for the plant.

MONTEREY, VA.—W. F. Kyle, of the Monterey Water, Light & Plumbing Company, has purchased a site for an electric light plant, and preliminary work has commenced on construction of the power house. Mr. Kyle was granted a 30-year franchise last year. P. H. Trout, of Staunton, Va., electrical engineer, is making estimates, etc., for the proposed plant.

RICHLANDS, VA.—A franchise has been granted to Messrs. Clark & Davy to construct and operate an electric light plant and water works in the Town of Richlands. They have also secured a contract to light the streets of the town with 40-watt tungsten lamps.

CHEWELAH, WASH.—The City Council is considering plans for increasing the output of the municipal electric light plant from 55 hp to 190 hp. It is said that a fall of 300 ft. can be secured from Chewelah Creek by going above the present site of the wheel. The cost of the work is estimated at about $5,000.

FRIDAY HARBOR, WASH.—The Western Mills & Lumber Company has been granted an electric light franchise in Friday Harbor.

HAYES, WASH.—A company has been organized to construct a telephone line from Hayes to Etna, connecting with the main line at La Center or Woodland. Eighteen miles of pole line will be erected. The officers of the company are: Walter Horton, president; H. F. Hewett, vice-president; August Scottburg, secretary, and E. Roslund, treasurer.

PASCO, WASH.—The property and holdings of the Pasco Power & Water Company have been transferred to a group of Seattle capitalists under the name of the Burbank Power & Water Company. The properties include valuable water rights on the Snake River at Five-Mile Rapids, four miles above Pasco; several thousand acres of rich sage brush land in the Columbia River fruit belt, and power plant, irrigation system and townsite of Burbank, in Walla Walla County. The officers of the new company are: James D. Hoge, president; Jacob Furth, vice-president; C. E. Farnsworth, secretary and treasurer; William H. Parry and J. E. Chilberg are trustees, all of Seattle, Wash. It is said that bonds to the amount of $500,000 have been floated.

SEATTLE, WASH.—It is reported that the Seattle Electric Company will soon issue $1,150,000 in common stock, the proceeds to be used to carry on construction work already started and contemplated in and around Seattle, as well as to take care of bonds that fall due during the next few months.

SPOKANE, WASH.—A reduction of practically 27 per cent in the rates for electricity for lamps has been made by the Washington Power Company. The new schedule went into effect Sept. 1 and is on a sliding scale as follows: For the first 30 kw, 10 cents per kw-hour; 9 cents per kw-hour for the second 20 kw; 8 cents for the third 20 kw, and 5 cents per kw-hour for all energy consumed above 60 kws. Under the old rates the prices were 13 cents per kw-hour for the first 25 kw; 12 cents for the next 15 kw; 11 cents for the next 20 kw, and 10 cents for all energy consumed by lamps for residential lighting in excess of 60 kw and less than 150 kw. Under the new schedule the definition of residential lighting will be strictly enforced.

TEKOA, WASH.—Arrangements have been made between the City Council and the Idaho & Washington Light & Power Company, whereby the latter will furnish electricity for lighting the streets of the town for $75 per month. The company is to furnish 30 lamps of 80 cp at the rate of $2.50 each per month.

ALGOMA, WIS.—The capital stock of the Algoma Farmers' Telephone Company has been increased from $500 to $2,500.

EAU CLAIRE, WIS.—We are informed that the Chippewa Valley Railway, Light & Power Company has closed a contract with the Red Wing Gas Light & Power Company, of Red Wing, Minn., to supply it with electrical energy to operate its entire plant. Work has commenced on the construction of the transmission from Menominee to Red Wing, a distance of 40 miles. The company expects to have its transmission line completed and to furnish electricity in Red Wing about Jan. 1, 1910. Electrical energy will be developed from one of the dams owned by the company on Red Cedar or Menominee River. George B. Wheeler is secretary and general manager of the Chippewa Valley Railway, Light & Power Company.

MANITOWOC, WIS.—Plans are being made by the Wisconsin Telephone Company for the extension of its telephone toll lines between Milwaukee and Green Bay along the lake shore. Work will soon be under way from Manitowoc to the Bay.

NEW RICHMOND, WIS.—The Washington County Light & Power Company, of Stillwater, Minn., has taken over the entire gas, electric light properties and franchises of the Apple River Power Company and the Western Gas & Improvement Company. It is said that extensions and improvements are contemplated which will involve an expenditure of about $210,000.

STURGEON BAY, WIS.—The capital stock of the Door County Telephone Company has been increased from $1,500 to $10,000.

CASPER, WYO.—The entire system of the local electric light plant has been changed from direct to alternating current, which has required considerable change in pole lines, as well as replacement of the direct-current generators and switchboard by alternating-current equipment.

LACOMBE, ALTA., CAN.—The town is considering the installation of a municipal light and power plant. Service, until recently, was given by the Blindman River Electric Light & Power Company, which has been obliged to shut down owing to the washing out of its dam, and it is estimated repairs cannot be completed within a year.

VANCOUVER, B. C., CAN.—An engineer will be appointed to make report with a view to the city purchasing an extensive water power at Lilooet to be used in connection with the erection of a municipal power plant. For further information address Alderman Goodman.

WINNIPEG, MAN., CAN.—The Manitoba Telephone Commission ha divided its work between three superintendents, each having charge of a department which will be known as traffic, commercial and plant. The province will be divided into six divisions with a superintendent for each department in each division who will report to the head superintendent, and the head superintendent will be responsible to the commission.

SHEDIAC, N. B., CAN.—Plans are under way for the construction of an electric light plant in Shediac. It is proposed to utilize the water power at Smith's Mills. A company has been organized under the name of the Shediac Electric Light & Power Company, of which A. E. Smith is president. It is stated that the capital required will not exceed $15,000, a greater portion of which has been subscribed.

BROCKVILLE, ONT., CAN.—It is reported that plans are being considered for rebuilding the municipal electric light plant.

GUELPH, ONT., CAN.—The Civic Light and Power Commissioners have awarded a contract to Vandeleur & Nichols for two large frequency changer sets and switchboards and for motors manufactured by the Lancashire Dynamo & Motor Company, aggregating about 1600 hp.

TORONTO, ONT., CAN.—The entire system of telephones along the line of the Temiskaming & Northern Railroad is to be reconstructed, and several important extensions will be built this year.

TORONTO, ONT., CAN.—Bids will be received by the city of Toronto until Oct. 28 (an extension of date from Oct. 14) for turbine pumps, valves, piping, bed plates, couplings, etc. The date for receiving bids for electric motors, with exciters, switchboards, connecting material, etc., has also been extended from Oct. 14 to Oct. 28.

COATICOOK, QUE., CAN.—The citizens are considering the question of establishing an electric light plant in Coaticook. The proposition to appropriate money for the plant will soon be submitted to a vote.

MONTREAL, QUE., CAN.—An announcement is made that on and after Oct. 1 the Montreal Light, Heat & Power Company will give a discount of 33⅓ per cent on 5-year contracts against the present discount of 15 per cent.

MONTREAL, QUE., CAN.—The Canadian Light, Heat & Power Company is reported to have made arrangements with J. G. White & Company, of New York, N. Y., for the engineering work and supervision of the construction of its proposed hydro-electric plant on the St. Lawrence River, near St. Timothee, Que. The company has secured permission from the Government to enlarge and use the Beauharnois Canal for power purposes. The present plans provide for an initial development of 21,600 hp, with provision for further developments, as may be required. The work includes the construction of a canal; enlargement of the Beauharnois Canal from the intake to the station site; construction of forebay at the power site; a power station for four main units and two exciter units; tailrace excavation for the complete ten units; transmission line to Montreal, and erection of substation and distributing system in Montreal. Plans and specifications are now being prepared by the enginers. The cost of the initial development is estimated at $4,000,000.

MONTEREY, MEX.—The damage to the electric light plant, street railway system, by the recent flood, all of which are owned by the Monterey Railway, Light & Power Company, is estimated at $2,000,000. William McKenzie, of Toronto, Ont., Can., is president.

TORREON, MEX.—Another large electric power plant and transmission system, backed by American capital, is being promoted in Mexico. It will be operated under the name of the Nazas River Power Company, the organization of which has just been completed. The hydro-electric plant will be located in the Ferndale Canyon, about 80 miles above the city of Torreon. The Nazas River, which flows through this canyon, will be utilized by the construction of a high dam across the narrow gorge. The initial output of the plant will be 20,000 hp, which can be increased as the demands may require. It is stated that contracts have already been signed for all of the 20,000 hp. The transmission lines will extend to the cities of Torreon, Gomez, Palacio, Lerdo, San Pedro, Mapimi, Durango, Velardena and other places. Electricity will be supplied chiefly to mining districts and industrial plants. The contracts call for the completion of the plant by Jan. 1, 1911. The cost of the plant and transmission lines is estimated at about $10,000,000. The officers of the company are: J. A. Spofford, of New York, N. Y., president; L. H. Hacker, vice-president and general manager, and C. A. Bobst, secretary. The office of the company will be at Torreon, Mex.

## New Industrial Companies.

THE INTERNATIONAL GAS & ELECTRIC FIXTURE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $4,000, to manufacture gas and electric fixtures by Joseph Moshkowitz, Isaac Wolsky, Samuel Berlin and William Rubin, all of Brooklyn, N. Y.

THE MANHATTAN RAILWAY SUPPLY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $110,000 by A. J. Hammerslough, A. L. Strasser and L. M. Wallstein, all of New York, N. Y. The company proposes to manufacture and deal in railway supplies.

THE OLDHAM ENGINEERING COMPANY, of New York, N. Y., has been incorporated by David J. T. Oldham, William S. Miller, Buel C. Haff, all of New York, N. Y. The company is capitalized at $20,000 and proposes to manufacture generators, engines, pumps, bridges, structures, etc.

THE PUBLIC SAFETY APPLIANCE COMPANY, of Albany, N. Y., has been chartered with a capital stock of $3,000 to manufacture fire, police and watchman alarm systems and appliances. The incorporators are: Perry J. Fitzgerald, George Haswell, of Albany, N. Y., and Theodore M. Brush, of Elyria, Ohio.

THE REPUBLIC ELEVATOR & MACHINE COMPANY, of Rochester, N. Y., has been incorporated by F. A. Stoffel, G. H. Fagan and H. L. Morgan, all of Rochester, N. Y. The company is capitalized at $30,000 and proposes to manufacture machinery, elevators, tools, etc.

THE SANDY STREAM DAM & IMPROVEMENT COMPANY, of Augusta, Maine, has been incorporated with a capital stock of $25,000, for the purpose of erecting and maintaining dams, etc. F. E. Smith is president, and J. H. Sturgis, treasurer, both of Augusta, Maine.

THE SCIPLE-GOCHENAUR MANUFACTURING COMPANY, of Trenton, N. J., has been incorporated by C. R. Ruhlman, of Trenton, N. J.; J. H. Boyer and W. B. Warnes, of Philadelphia, Pa. The company proposes to manufacture boilers, marine and other engines. Also to take over the business of W. N. Gochenaur, 631 Arch Street, Philadelphia.

THE STANDARD GAS & ELECTRIC POWER COMPANY, of West Philadelphia, Pa., has been incorporated with a capital stock of $600,000 for the purpose of manufacturing automobiles, which will be operated by both gas and electric motive power. Samuel S. Eveland, president of the Standard Bearing Company, is interested in the company.

## New Incorporations.

GADSDEN, ALA.—The Noccalula Light & Power Company has filed articles of incorporation with a capital stock of $100,000 for the purpose of constructing a hydro-electric power plant at Black Creek Falls. The officers of the company are: Joseph M. Baker, president; Joseph B. Evans, vice-president, and Joseph P. Parish, secretary and treasurer.

SANTA BARBARA, CAL.—The Merchants' Mutual Light & Power Company has been incorporated to effect the consolidation of the Merchants' Mutual and Edison companies. The new company has a capital stock of $1,000,000 and its directors are C. H. Frink, John F. Diehl and H. R. Weldon, of Santa Barbara; S. M. Kennedy, of Alhambra; R. H. Ballard, William Dieterle and Herbert F. Keenan, of Los Angeles; L. J. Lee and H. J. Bauer, of Pasadena. The first three are understood to represent the stockholders of the Mutual company, which was financed by local men, while the Los Angeles and Pasadena directors are associated with the Edison company of Los Angeles, which will hold a controlling interest in the local company. The principal place of business is Santa Barbara.

SAN FRANCISCO, CAL.—The Solano-Yolo Land & Water Company has been chartered, with a capital stock of $500,000, by C. M. Wooster, of San Jose, Cal.; Harvey S. Loveland, H. H. Sanborn, F. H. Gould and S. R. Chapel, all of San Francisco. The company proposes to erect a dam at Hell's Gate, west of Winters, to develop electrical power and to divert water at the same point for irrigation purposes in Yolo and Solano counties.

LEWISTON, IDAHO.—The Northwestern Corporation of Walla Walla has been incorporated with a capital stock of $5,000,000. It is said that the company was formed by the same interests that own the local gas company and operate in several towns, including Pendleton, Eugene and Albany, Ore.

GOLDEN, ILL.—The Golden Farmers' Telephone Company has been organized to install a telephone system in Golden. The directors are: L. G. Clark, E. C. Sherrow, Andrew Bartell, Scott Taylor and John P. Beckman.

MONTICELLO, IND.—The Indiana Northwestern Traction Company, with headquarters in this city, has incorporated with a capital stock of $50,000. The company proposes to construct, finance, equip and operate an electric railroad from Hammond to Lafayette. The company also proposes to furnish electricity for lamps and motors to towns and cities along its route. Charles D. Meeker, William Breckner, Jacob Timmons, of Monticello; George W. Goff, Rensselaer, and George A. Haskell, of Chicago, Ill., are directors.

CLARION, PA.—Articles of incorporation have been filed for the Clarion & East Brady Electric Railway Company by G. E. Arnold, R. M. Werner, T. S. Arnold, I. N. Langham and E. W. Witherell. The company proposes to construct an electric railway from Clarion to East Brady, via Sligo and Rimersburg, a distance of 25 miles.

HARRISBURG, PA.—Charters have been granted to the Aston Electric Light, Heat & Power Company, the Marple Electric Company, the Middletown Electric Light & Power Company and the Nether Providence Electric Company. Each company is capitalized at $5,000. The following named parties are directors of all of the companies: H. E. Marlor, of Philadelphia, Pa., treasurer; H. W. Rhodes and W. Roger Fronfield, of Media, Pa.

HOLLIDAYSBURG, PA.—The Juniata Electric Light, Heat & Power Company has been incorporated with a capital stock of $5,000. The directors are: Harry D. Hewitt, treasurer; John T. Leet and Peter S. Duncan, all of Hollidaysburg, Pa.

LIMERICK, PA.—The Limerick Telephone Company has been granted a charter by the State Department. The company is capitalized at $5,000.

SAN ANGELO, TEX.—The San Angelo Street Railway Company has been organized, with a capital stock of $100,000, to construct an electric railway from San Angelo to Carlsbad and Sterling City. The directors are W. H. Shaffer and A. H. Shaffer, and J. J. Lanin, of New Hampton, Ia., manager.

LAGRANGE, TEX.—The Southern Texas Telephone Company has been incorporated, with a capital stock of $20,000, by C. C. Robson, H. C. Schumaker and M. V. Povlitz.

ALEXANDRIA, VA.—The Braddock Light & Power Company has been chartered, with a capital stock of $5,000, to construct and operate an electric light plant. The officers of the company are: Clarence F. Norment, president; F. J. Whitehead, secretary, and H. W. Fuller, treasurer, all of Washington, D. C.

NORTON, VA.—The Norton Light & Power Company has been chartered, with a capital stock of $25,000. The officers of the company are: W. N. Surface, president; J. B. Sterrett, vice-president and general manager, and G. H. Esser, secretary and treasurer.

WAVERLY, VA.—The Surry & Sussex Telephone Company has been incorporated, with a capital stock of $3,000 and the following-named officers: J. E. Wilcox, president; J. W. Rogers, of Waverly, secretary and treasurer, and W. O. Rogers, of Savedge, Va., manager.

TACOMA, WASH.—Articles of incorporation of the Northwestern Electric Company have been filed by City Electrician F. H. Lauzon, E. L. Hollingstead, H. D. Nowlin, F. McFarland and J. P. Covert. The capital stock is placed at $300,000.

WALLA WALLA, WASH.—Articles of incorporation have been filed for the Spokane, Walla Walla & Western Railway Company by E. M. Symonds, M. S. Parker, G. S. Haynes, A. H. Hoffman and E. C. Maxon, of Spokane, Wash.; H. M. Hanger, of Dayton, and W. L. Russell, of Walla Walla. The company is capitalized at $1,000,000, and has taken over the holdings of the Columbia & Walla Walla Traction Company, which proposed to construct an electric railway from Dayton to Wallula, a distance of about 60 miles.

ARGYLE, WIS.—The Argyle Telephone Company has been chartered with a capital stock of $5,000 by A. G. Hawley, H. F. Hawley and D. S. Hawley.

CENTER, WIS.—The Twelve Corners & Mackville Telephone Company has been incorporated, with a capital stock of $8,000, by Martin Striegal, C. F. Giedt and John L. Parker.

RIDGEVILLE, ONT., CAN.—The Ridgeville Electric Light & Power Company has been organized by George Arnold, of Ridgeville; Hugh A. Rose and Frank W. Houston, of Welland; J. C. Stoat, of Fenwick, and H. S. Arnold, of Toronto. The company is capitalized at $40,000 and proposes to supply electricity for lamps and motors in the townships of Thorold, Pelham and Gainsboro. Franchises have already been secured in Thorold and Pelham.

## Legal.

RECEIVER FOR THE JUNIATA WATER & POWER COMPANY.—A bill of equity has been filed in the Common Pleas Court No. 1 for a receiver for the Juniata Water & Power Company, of Huntingdon, Pa. The company defaulted on its first mortgage 5 per cent bonds last May, and the present suit is the result of that and differences as to the management and reorganization of the company. The capital stock outstanding is $7,500,000, and also an indebtedness of the same amount, consisting of first mortgage 5 per cent bonds. A second mortgage of $500,000 is authorized but not issued.

RECEIVER APPOINTED FOR THE SOUTHERN COLORADO POWER COMPANY.—District Judge Henry Hunter has appointed Frank P. Read, of Denver, Col., receiver of the Southern Colorado Power Company, of Trinidad, Col. The company is said to be solvent in every way and the receivership method is used in preference to foreclosing, in order that time may be saved in rebuilding and enlarging the plant, and was agreed upon by the stockholders when Brown Brothers, of New York, N. Y., consented to take over the controlling interest in the company and organize a new and larger corporation. The new company will have a capitalization of $5,000,000, and ample capital will be available to make all improvements and extensions as they are needed. The receiver, it is understood, with the permission of the court, will immediately order new machinery for the plant. It is said that the plant which was destroyed by fire in June will be replaced in a few months by a new and larger station. Mr. Read was formerly owner of the Trinidad Electric Light Company and the Trinidad Street Railway Company.

## Personal.

MR. A. GRONWALL, of Ludvika, Sweden, is in Ottawa in connection with the establishment of several electrical furnaces in Canada for smelting ores. He will consult with Dr. Haanell, of the Department of Mines, who has given special attention to the subject of electric smelting.

MR. S. L. PRENTER, who for 24 years has been connected with the Canadian Pacific Railroad, has been appointed assistant manager of the British Columbia Electric Street Railway system with charge of the branch line now being built between New Westminster and Chilliwac, B. C.

MR. WILLIAM RAY, of Chicago, has been appointed general manager of the Northern Indiana Gas & Electric Company's interests in Michigan City, Hammond, East Chicago, Indiana Harbor, Whiting, West Hammond, Burnham and Chesterton. These properties form part of the Geist Gas & Electric Syndicate, of Philadelphia.

MR. L. J. B. WALL, of Perth, Western Australia, has acted as an expert in arbitration proceedings attending the proposed purchase by the city of Perth of the electric light and gas properties of that place, the value of which is about $2,000,000. According to *The West Australian*, Mr. Wall, who is a member of the American Institute of Electrical Engineers, was on the stand for more than a week continuously.

MR. HAROLD K. WELD resigned his position in the engineering department of the Chicago Telephone Company Sept. 1 to enter the sales department of the McRoy Clay Works, manufacturers of underground conduits. His office will be at The Rookery, Chicago, Ill. Mr. Weld's work with the Chicago Telephone Company has been for the past four years in connection with the engineering of underground conduit construction, and this new work is therefore of a kind for which he is well fitted by his previous experience.

MR. ERNEST GONZENBACH has been elected president and general manager of the Sheboygan Light, Power & Railway Company, Sheboygan, Wis., to succeed the late Dr. F. A. C. Perrine. Mr. Gonzenbach was formerly vice-president and treasurer of the company, and Mr. August Westermeyer, heretofore auditor of the company, has been elected to succeed him as treasurer. During the five years Mr. Gonzenbach has been connected with the company the gross earnings have almost doubled and the net earnings have more than trebled. Mr. Gonzenbach's election to the presidency will not mean any change in the policy or personnel of the company, beyond that mentioned in the case of Mr. Westermeyer.

MR. ALFRED J. THOMPSON, 71 Broadway, New York City, who, since his departure from four years' service in the laboratory of Thomas A. Edison, in 1893, has devoted his entire time to the sale, installation and operation of American machinery in Latin American countries, is about to form a selling organization for business in this rapidly developing part of the world. In his 16 years' experience traveling through every republic in Central and South America, he has gained the good will and personal regard of their largest consumers. The organization will have its headquarters in New York and Mr. Thompson will make occasional trips to these countries to call on resident representatives. His traveling associates all speak Spanish and have had extensive shop and selling training in the United States.

## Trade Publications.

LUBRICATION.—Lubricants of various kinds are well described in a neat booklet recently published by the Dearborn Drug & Chemical Works, Chicago, Ill.

ARC LAMP REGULATORS.—A regulator designed for governing the arc lamp used with moving picture shows is described in a folder issued by the Vindex Electric Company, Aurora, Ill.

TUNGSTEN LAMPS.—The economical features of the tungsten lamp, in comparison with the carbon lamps, are discussed in a convincing manner in folder No. 3850 of the General Electric Company.

FLAMING ARC LAMPS.—The constructive features and operating characteristics of the Alba flaming arc lamp are fully discussed in a booklet issued by the Charles L. Kiewert Company, of New York.

WATER SOFTENERS.—The advantages attending the softening of water for boiler feeding are outlined in a bulletin published by the Harrison Safety Boiler Works, Seventeenth Street and Allegheny Avenue, Philadelphia.

WIRING SPECIALTIES.—Bulletin No. 18 of the Harvard Electric Company, 60 West Van Buren Street, Chicago, Ill., is devoted to wiring hardware, including brackets, self-welding joints, switch boxes, outlet boxes and fuse blocks.

ELECTRICAL REPAIRS.—The Gregory Electric Company, Chicago, Illl., has issued a neat folder, which represents an effort on its part to double its repair business during the coming year, for which it has recently increased its facilities.

ASBESTOS ROOFING.—A roofing particularly designed for use on factories, power houses and similar structures is listed and fully described in catalog No. 303 of the H. W. Johns-Manville Company, 100 William Street, New York.

INDUCTION MOTORS.—The Triumph Electric Company, Cincinnati, Ohio, has issued Bulletin No. 351, giving a complete description of the constructive features of its polyphase induction motors. These motors are built in ratings from 1 hp to 75 hp.

AIR HEATERS.—Bulletin No. 123 of the Green Fuel Economizer Company, Matteawan, N. Y., deals with a waste-heat air heater, designed for utilizing the heat in chimney flue gases to raise the temperature of air for buildings and industrial drying processes.

RECIPROCATING ENGINES.—The American Engine Company, Bound Brook, N. J., is distributing a bulletin discussing in an instructive manner the considerations affecting the floor space, steam economy, valve design and balancing of automatic high-speed engines.

INCANDESCENT LAMPS.—Bulletin No. 8A of the Western Electric Company, of Chicago, Ill., is devoted to the Sunbeam incandescent lamps. The lamps are of the tungsten miniature and low-voltage types. The bulletin contains complete illustrated descriptions of each of the types listed.

ELECTRIC CARRIAGES.—The 1909 catalog of the Rauch & Lang Carriage Company, Cleveland, O., is a well-executed pamphlet giving information in detail relating to electric pleasure vehicles. The carriages are built as runabouts, stanhopes, victorias, surreys and all of the various styles required in high-class service.

LAMP FITTINGS.—The British Thomson-Houston Company, Rugby, England, has issued, as price list No. 220, a bulletin devoted to tungsten lamp fittings, which have been developed for the purpose of running the lamps in groups so as to perform the work formerly accomplished by means of arc lamps.

ARC LAMPS.—A self-regulating arc lamp, designed without clockwork and intended for use with all standard values of current, voltage and connections, and with which either flamming electrodes or pure carbon electrodes may be used, is described in a catalog issued by the Regina Arc Lamp Works, Ltd., Cologne-Sulz, Germany.

INSULATION.—Of unusual interest is the catalog of the Massachusetts Chemical Company, of Walpole, Mass., which gives a résumé of the liquid, plastic and solid insulations, tapes, fabrics and molded rubber goods which it manufactures. The specific use for which each insulating material is best adapted is fully discussed.

PUMPS.—Price lists and brief descriptions of pumps intended for operation by means of small motors are contained in Bulletins Nos. 102, 103 and 104 of the Jarvis Engine & Machine Works, Lansing, Mich. Bulletin No. 101 gives general information concerning these pumps, while Bulletin No. 105 is devoted to automatic controllers for motor-driven pumps.

TELEPHONES.—The De Veau Telephone Manufacturing Company, 472 Eighteenth Street, Brooklyn, N. Y., has issued as its fourteenth catalog a 56-page publication, giving complete information concerning its various lines of telephones and telephone supplies. A price list is given relating to each of the devices dealt with, and circuit diagrams are shown for all of the usual telephonic arrangements.

AUTOMOBILE ROUTE BOOK.—The Studebaker Automobile Company, South Bend, Ind., has issued a 149-page automobile route book, which gives many popular routes between the principal cities of the Central States. It gives maps of each route, and also the total mileage and intermediate mileage of every route. Copies of this book can be obtained by addressing the route department of the company, at South Bend.

ELECTRIC SPECIALTIES.—The G. & W. Electric Specialty Company, 128 West Jackson Boulevard, Chicago, Ill., has issued a number of folders descriptive of its various electrical devices. Bulletins Nos. 30, 31, 32, 34, 35, 36 and 37 deal with pot heads, while combination pot heads are described in Bulletins Nos. 39, 41 and 42. Safety line disconnectors are treated in Bulletin No. 33, and ground pipe caps in Bulletin No. 38. An illustrated pamphlet, designated as Folder A, shows some typical installations where these devices are employed.

## Business Notes.

CHARLES F. BEAMES has resigned from the staff of J. G. White & Company to accept the position of general manager of the Cobalt Power Company, Cobalt, Ont.

NEW FACTORY OF TRIUMPH ELECTRIC COMPANY.—The Triumph Electric Company will very shortly move into its new factory, situated in Oakley, a suburb of Cincinnati, Ohio.

THE ELECTRIC CONSTRUCTION COMPANY, Little Rock, Ark., will move to larger quarters on Oct. 1, owing to increase in business and the addition of a department for manufacturing and finishing chandeliers.

SUNBEAM HIGH-VOLTAGE TUNGSTENS.—The Western Electric Company announces that it is now in a position to furnish Sunbeam tungsten lamps in voltages between 200 and 250. The lamps are made in four sizes at present, namely, 45, 70, 112 and 180 watts, and have given up to date equally as good satisfaction as tungsten lamps of 110 volts range.

BLUMENTHAL-KAHN ELECTRIC COMPANY.—S. C. Blumenthal and A. Kahn have formed a partnership as electrical contractors and dealers in electrical supplies, with offices at 8 South Howard Street, Baltimore, Md. Both of the members of the firm were formerly with the Jos. M. Zamoiski Company, and have had a long experience in the installation of interior wiring and electrical construction generally.

WILLIAMS & WILSON have opened an office at 39 Cortlandt Street, New York, N. Y., as dealers in electrical specialties, and will represent several large firms with standard lines, and the experience of these two men in the electrical field insures success. Mr. J. E. Wilson for the past nine years has represented the Stuart-Howland Company, of Boston, Mass., in the New York State territory, and previous to that was for nine years with the Pettingell-Andrews Company. Mr. G. G. Williams, of this firm, has also had a large experience both in selling and manufacturing.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS, ISSUED AUGUST 31, 1909.

[Conducted by W. F. Bissing,, Pat. Law, 2 Rector St., N. Y. City.]

932,426. TROLLEY REPLACER; W. M. Austin, Swissvale, Pa., and S. C. Cooper, Johnstown, N. Y. App. filed May 3, 1907. A spring pressed piston returns the trolley pole and arms above the wheel surround the wire and prevent the wheel from leaving it.

932,433. COVERLET; C. R. Bold, Charleston, S. C. App. filed April 10, 1909. Outlet box having detachable end sections with flanges to cover the ends.

932,441. ELECTRIC WELDING MACHINE; A. E. Buchenberg, Toledo, Ohio. App. filed Aug. 19, 1908. Separate work carrying means, a single transformer with its secondary connected with said means, and a mechanism to carry the current, the articles held by the work holder.

932,459. METHOD OF REDUCING AND MELTING OXIDS AND THE LIKE; O. Frick, Sheffield, England. App. filed April 19, 1907. Reduces the solid material by placing it between electrodes above an annular crucible and then melt the reduced material by induction.

932,469. ELECTRIC FURNACE; J. A. Hay, London, Eng. App. filed June 19, 1909. Has a passage for the limbs of the core and a winding and a metallic shield with a large radiation surface.

932,481. CURRENT INTERRUPTER FOR ELECTRIC CIRCUITS; F. W. Lord and F. W. Erickson, New York, N. Y. App. filed April 27, 1907. Includes two electrodes and a disk having a series of separate metallic segments with means for changing the relative positions between electrodes and segments.

932,505. ELECTRICAL SIGNALING SYSTEM; F. M. Slough, Elyria, Ohio. App. filed July 10, 1906. A plurality of current producing means individually driven at constant but different speeds with a synchronizer.

932,511. TROLLEY; N. W. Storer and T. Varney, Pittsburgh, Pa. App. filed Oct. 18, 1905. A pivotal arm having a piston rod connected thereto and movable switch contact member, both arm and switch being simultaneously movable.

932,519. TROLLEY FOR ELECTRIC VEHICLES; T. Varney and N. W. Storer, Pittsburgh, Pa. App. filed May 23, 1908. A trolley having a plurality of contact members and a wind vane for adjusting some of them as the speed increases.

932,523. INSULATOR FOR THIRD RAILS; E. M. Weaver, Ozone Park, N. Y. App. filed Sept. 10, 1908. A metallic standard with a flat ring-shaped seat at the top and inverted cup-shaped having ring face and a downwardly projecting portion.

932,537. DYNAMO-ELECTRIC MACHINE; A. L. Cushman, Concord, N. H. App. filed Feb. 15, 1908. A frame for the field and the commutating magnets, having a commutating magnet core besides the main core for overcoming armature reaction.

932,538. TROLLEY; H. P. Davis and T. Varney, Pittsburgh, Pa. App. filed Nov. 8, 1907. A supporting frame with a cross rod at its upper extremity and a pair of elongated contact shoes separated from each other and having lateral projecting arms with a spring to force the shoes together.

932,539. CURLING IRON HEATER; H. W. Denhard, San Francisco, Cal. App. filed Aug. 10, 1908. A heating chamber with a resistance coil in it and a central cone with electrical connections with a space between the cone and chamber.

932,541. ABNORMAL POTENTIAL DISCHARGING AND ARC DISRUPTING DEVICE; F. W. Erickson and F. W. Lord, New York, N. Y. App. filed April 27, 1907. For overhead transmission lines to prevent lightning flashes by an arc dissipator having a plurality of disks immersed in oil and driven by a motor.

932,545. TELEPHONE ANTISEPTIC MOUTHPIECE; J. M. Haff, Los Angeles, Cal. App. filed April 24, 1907. A telephone mouth-

piece having a lining, an absorbent antiseptic disk and a gauze retainer to secure the disk in the lining.

932,554. TROLLEY; R. P. Jackson and C. Aalborg, Wilkinsburg, Pa. App. filed April 28, 1906. The shoe is supported by jointed links pressed by a spring and piston.

932,557. SWITCH HOOK CONTROLLING DEVICE; M. M. Kahn, Louisville, Ky. App. filed Oct. 29, 1908. For holding the receiver by means of an arm attached to the transmitter support and weighted to cut out the line.

932,570. SUPPORTING PIN FOR INSULATORS; F. A. C. Perrine, (Deceased) Plainfield, N. J. App. filed Oct. 17, 1908. A wrought metal tube with its lower end flanged through which a securing bolt passes.

932,613. ARC LAMP CUT-OUT; L. E. Jones, Anaconda, Mont. App. filed Jan. 28, 1909. A hanger having a cylinder of conducting sections and insulating material. Details.

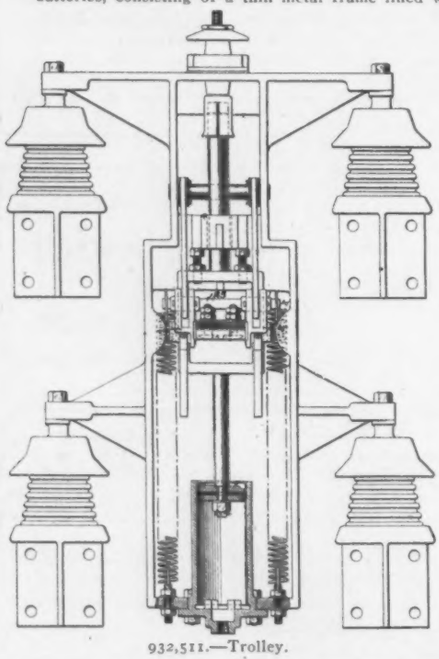
932,616. BRUSH FOR DYNAMO-ELECTRIC MACHINES; E. R. Knight, Norwood, Ohio. App. filed Feb. 7, 1906. A carbon block has a channel engaging a guide plate with a conductor clip on the opposite side of the brush.

932,622. COMPOSITION OF MATTER; T. D. Lynch, Wilkinsburg, and J. Crane, Swissvale, Pa. App. filed Jan. 10, 1908. An insulating cement containing asphalt, brick dust, china clay, etc.

932,625. INDUCTION MOTOR; E. Mattman, Norwood, Ohio. App. filed Sept. 5, 1905. A shaft having a plurality of collector rings with winding terminals connected thereto with an axially sliding member for short-circuiting the rings.

932,627. WINDOW COVERING; J. E. Medland and L. E. Capps, Seattle, Wash. App. filed Sept. 10, 1908. Guard consisting of hollow rods, holding a fluid which when the fluid runs out rings an alarm.

932,637. CONTAINER FOR SECONDARY BATTERIES; E. L. OPPERMANN, London, Eng. App. filed Aug. 22, 1908. For holding batteries, consisting of a thin metal frame lined with vulcanite.



932,511.—Trolley.

932,641. DYNAMO-ELECTRIC MACHINE; W. D. Pomeroy, Norwood, Ohio. App. filed June 16, 1906. A stator for integral bearing housings, a rotor with adjusting wedges for the rotor shaft and bolts for holding them in position.

932,651. TROLLEY; T. Varney, Pittsburgh, Pa. App. filed Jan. 16, 1906. A contact member and a pantograph therefor with a spring for expanding the frame, and pneumatic means for collapsing the frame.

932,652. TROLLEY FOR ELECTRICAL VEHICLES; T. Varney, Pittsburgh, Pa. App. filed April 5, 1907. Sliding trolley with auxiliary contacts having springs adapted to follow the variations in the supply line.

932,653. TROLLEY; T. Varney, Pittsburg, Pa. App. filed April 5, 1907. A supporting frame and galvanized steel contact plate having an upward curvature from end to end.

932,654. TROLLEY; T. Varney, Pittsburgh, Pa. App. filed Nov. 8, 1907. A supporting frame and a pair of bow contact shoes with their bow faces outward and rotatively adjustable relative to the frame.

932,655. TROLLEY FOR ELECTRIC VEHICLES; T. Varney, Pittsburgh, Pa. App. filed April 22, 1908. As the speed increases, wind actuated vanes press the contacts mounted on a pantograph with increased force against the wire.

932,656. TROLLEY FOR ELECTRIC VEHICLES; T. Varney, Pittsburgh, Pa. App. filed Oct. 7, 1908. A main shoe and auxiliary strips, parallel to the main member.

932,661. DIRECT-CURRENT TURBO-GENERATOR; A. H. Wouters, Norwood, Ohio. App. filed Nov. 3, 1906. A laminated core, coils and an end clamp with an annular shoulder.

932,662. ROTOR CONSTRUCTION; A. H. Wouters, Norwood, Ohio. App. filed Jan. 31, 1907. A shaft, a core, windings, a collector ring and overlapping straight rods for connectors.

932,700. AUTOMATIC MAIL CARRIER; P. M. Hacking and A. H. Bastian, Milwaukee, Ore. App. filed July 11, 1908. An electric motor driven telpher on a trolley wire.

932,707. ELECTRIC LOCOMOTIVE; W. F. Hunt, New York, N. Y. App. filed Nov. 21, 1907. Circuits including storage battery, a three-arm trolley and two contacts connected to one side of the motor, the other side being connected to the trolley contact.

932,753. CALL BOX; H. S. Bullock, Jr., New York, N. Y. App. filed Jan. 17, 1907. A break wheel and brush with a driving member moving a shorter distance for one class of signals than the other.

932,773. ELECTRIC ARC LAMP; J. B. Fournier, Paris, France. App. filed Nov. 21, 1903. Regulator includes an automotor elastic tube with a spiral tube therein, a resistance between the spirals, the tube filled with liquid. For each vapor pressure, the end of the tube assumes a definite position.

932,775. ELECTRO-THERAPEUTIC INSTRUMENT; C. W. Gaston, Fresno, Cal. App. filed June 5, 1909. A tube open at both ends and exteriorly grooved with wires of opposite metals in the grooves.

932,792. SWITCH FOR ELECTRIC LAMPS; E. A. Lefebre, Jr., and W. I. Miller, Brooklyn, N. Y. App. filed Jan. 13, 1909. An insulating block with a two part shaft thereon and a rotatable contact maker secured to one pair of the shaft and insulated therefrom.

932,799. COHERER; W. W. Massic, Providence, R. I. App. filed Aug. 16, 1905. Like patent No. 809,119 with special construction of bridge so that it can be separated from the supports without throwing tapper out of adjustment.

932,819. OSCILLIAMETER; H. Shoemaker, Jersey City, N. J. App. filed Dec. 11, 1906. For producing and measuring wave lengths of definite frequency by means of a condenser and inductance and scale.

932,820. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Aug. 19, 1907. On oscillation circuit containing pairs of inductance and a capacity, the pairs in parallel with means for discharging the capacities through the inductances and an oscillation circuit in getting its energy therefrom.

932,821. TELEPHONE AND TELEGRAPH TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed July 25, 1908. Wireless telegraph having a continuous oscillating circuit of a low, natural period above the limit of audition, a high frequency, disruptive oscillation circuit, deriving energy from the first circuit; a radiator and means for controlling the radiator to represent a signal.

932,835. ELECTRIC FURNACE; J. B. Trillon, St. Jeoire, France. App. filed July 6, 1907. Two electrodes and a conducting bath forming two hearths with a third conductor for the return current.

932,841. BATTERY COVERING; G. E. Andrews, Providence, R. I. App. filed May 21, 1909. Two part rubber covering for making the battery water tight.

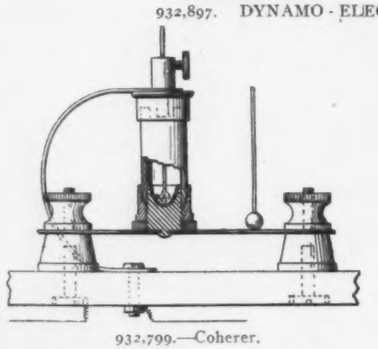
932,863. CIRCUIT BREAKER; J. B. and H. E. Howe, Windber, Pa. App. filed March 19, 1909. For trolley wires. Details.

932,877. AUTOMATIC SYNCHRONIZER; H. Marshall, Vance, Colo. App. filed Oct. 6, 1906. For connecting an alternator to busbars by means of transformers, synchronizing switches, and a trip switch.

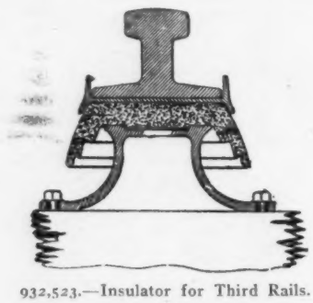
932,883. PUSH BUTTON ELECTRIC SWITCH; L. H. Moulthrop, Bridgeport, Conn. App. filed Nov. 12, 1908. A contact member and a detent comprising a spring acting as a retaining member.

932,896. ELECTRIC MOTOR; O. H. and A. F. Pieper, Rochester, N. Y. App. filed June 21, 1909. Suspended within a bracket; the field formed of disks.

932,897. DYNAMO-ELECTRIC MACHINE; A. A. Pifer, Cleveland, Ohio. App. filed April 1, 1909. A plurality of poles each with two pole pieces adjustable circumferentially and tapered.



932,799.—Coherer.



932,523.—Insulator for Third Rails.

932,898. ART OR PROCESS OF PRODUCING OZONE; J. F. Place, Glen Ridge, N. J. App. filed Feb. 26, 1909. Evaporates oxygen gotten from the atmosphere and mixing the vapors with air and conducting through an ozonizer.

932,913. RECEIVING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed April 28, 1905. A looped aerial with a wave responder in one loop and an adjustable inductance bridging the legs of the loop.

932,935. GAS LIGHTER; W. D. C. Wright, Philadelphia, Pa. App. filed Sept. 19, 1908. The handle contains batteries and a spark coil. Details.

932,966. ELECTROTHERMOSTATIC HEAT REGULATOR; L. G. Copeman, Berkeley, Cal. App. filed Oct. 1, 1908. A movable electric heater with inferior resistances and a main heat circuit, a hood, a thermostat within it and a shunt circuit controlling the main heat circuit.

932,970. ELECTRIC LIGHT CORD ADJUSTER; O. Dodge, Colorado Springs, Col. App. filed Oct. 12, 1908. For drop lights having a spring actuated drum for the cord.

932,984. TROLLEY POLE BASE; C. C. Hale, Wapakoneta, Ohio. App. filed Feb. 17, 1909. The base is mounted in a housing and is carried on ball bearings.

932,986. TRANSFORMING SMELTING FURNACE; H. Helberger, Munich, Germany. App. filed Sept. 11, 1908. Terminal electrodes with secondary windings clamping a crucible between them, the electrodes having ducts for a cooling medium.

932,998. TROLLEY GUARD; F. V. Polakoskey, Peekskill, N. Y. App. filed March 17, 1909. A wheel with a bracket and vertical levers hinged thereto and above the same to surround the wire.

933,012. CIRCUIT MAKING AND BREAKING DEVICE; H. S. Baker, Wilkinsburg, Pa. App. filed March 23, 1906. For alternating current in which an elastic movable arm with a contact piece at one end is provided and has a retarding device at one end of the arm.

933,027. ABNORMAL POTENTIAL DISCHARGING AND ARC DISRUPTING DEVICE; F. W. Erickson and F. W. Lord, New York, N. Y. App. filed July 11, 1907. For lightning discharges. A plate driven by a motor lies between two electrodes for the spark gap.